TECHNOLOGY DEPT.

First Copy

A National Newspaper for Every Branch of the Industry

Automotive Daily News

★CARS★ SHOP EQUIPMENT TRUCKS ★★AVIATION★★ PARTS ACCESSORIES ★TIRES★

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PUBLIC LIBRARY OCT 2 1930 DETROIT

FACTORIES SEE PROFITS IN SERVICE

Heminway Tells Trade Association Convention Business Is on Upgrade

General Manager of M. E. A. Delivers Keynote Address at Annual Meeting; Reeves Of N. A. C. C. Is Chairman

NIAGARA FALLS, Ont., Sept. 25.—Choosing the theme of "The Trade Association's Part in Bettering Business Conditions," the eleventh annual convention of the American Trade Association executives is meeting here this week. About 400 delegates are in attendance.

The session opened yesterday morning with Alfred Reeves, general manager of the National Automobile Chamber of Commerce, presiding. The keynote address of the convention was given by M. L. Heminway, general manager of the Motor Equipment Association, in which he stressed the fact that American business was starting back the upgrade after a brief time in the doldrums.

"There is no one cause of our business depression," he said, "although economists differ on this and some will stoutly maintain that it is entirely due to overproduction. Existing difficulties in industry can to some extent be attributed to shortcomings in management and the lack of understanding of fundamentals that control the entire economic system of the country, with a failure to apply remedial measures to offset the mounting economic conflicts and difficulties which have arisen."

Virgil Jordan, economist of the McGraw-Hill Company, said that there were no underlying actualities to prevent vigorous and prompt re-

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BROSSEAU URGES STATE RECIPROCITY ON MOTOR TRAFFIC

Philadelphia, Sept. 25.—A. J. Brosseau, vice-president northwest division Chamber of Commerce of the United States and chairman of the truck division of the National Automobile Chamber of Commerce, at the second day's session of the traffic group of the Middle Atlantic States Regional Traffic Conference at the Ritz-Carlton Hotel, read resolutions calling for complete reciprocity between states in motor vehicle traffic, whereby double taxation and duplication of license tags would be obviated. This plan, though urged by the body in general, was opposed by S. B. Magee, Elizabeth, N. J., who contended that New Jersey is entitled to some form of tax from heavy buses and transport motor vehicles in traffic such as between Philadelphia and New York, and Baltimore and New York.

The adoption of standard signs, traffic signals and marking also was urged, as was the adequate marking of railroad crossings and the removal of obstructions at such points, including highway intersections. The employment of traffic engineers by cities was warmly

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NEW PRICE PUT ON TRUCK BY LA FRANCE-REPUBLIC

Alma, Mich., Sept. 25.—The La France-Republic Corporation has announced to its export and domestic distributor and dealer organizations a new price of $795 on its Model A, six-cylinder one-ton truck. This model has a six-cylinder motor, Timken full-floating axle, four-speed transmission, and Lockheed hydraulic brakes.

"No modifications have been made in this model in order to reach this new low price," states F. D. Soper.

MACK ANNOUNCES NEW SIX-CYLINDER MODEL AK TRUCK

New York, Sept. 25.—Mack Trucks, Inc., announce the addition to the line of Mack four and six cylinder trucks of a new Mack Model AK six, designed for heavy duty service where greater speed and power are essential. The AK six does not supplant the present Mack four-cylinder Model AK. It retains the Mack Bulldog type hood, and is offered with either a covered or coupe type Mack cab.

The new unit is powered by a Mack six-cylinder engine, with bore and stroke of 4½x5½ inches, and develops 126 horse power at 2,200 r. p. m. Pistons are of aluminum, and of the invar strutted type; connecting rods tubular, and the cylinders cast in block.

A drop forged crank shaft with integral counterweights and a vibration damper is used. Valves are flat seated, of L head type, and are located at the right. Lubrication is of the force feed and splash type. All oil is filtered through an H. W. filtrator.

Water circulation is by centrifugal pump controlled by a thermostat.

Transmission has four speeds for-

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HIGHEST METAL CONGRESS HONOR GOES TO H. J. FRENCH

CHICAGO, Sept. 25.—Award of the Howe medal, highest honor bestowed annually at the National Metal Congress, went to . French, metallurgist of the International Nickel Comp: Bayonne, N. J., according to announcement made at dnesday's sessions of the congress. The medal won by Mr. French is given at each convention to the man who delivered the outstanding paper at the previous year's meeting.

The subject of his paper last year was "Quenching of Steel," and he presented on that occasion a study of the behavior of steels when suddenly cooled from high temperatures.

More than a thousand men in attendance at the congress crowded into the meeting hall at the Stevens Hotel to hear Dr. Marcus A. Grossman deliver the Camp-

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S. D. BRYCE, JR., PROMOTED SUCCEEDS LONG IN N. A. C. C.

New York, Sept. 25.—Stephen D. Bryce, Jr., has been appointed manager of the educational department of the National Automobile Chamber of Commerce, succeeding John C. Long. Mr. Bryce has been assistant to E. F. Loomis in the motor truck division for the past six months.

Following graduation from the University of Virginia, Mr. Bryce received newspaper training with the Washington Associated Press Bureau and Toledo newspapers.

HARRY A. SMITH PROMOTED BY LA FRANCE-REPUBLIC

Alma, Mich., Sept. 25.—Harry A. Smith has been appointed sales manager of the La France-Republic Sales Corporation, according to an announcement by F. D. Soper, vice-president.

For the past fourteen years Mr. Smith has been connected with this company, moving up successively to more responsible positions.

TODAY

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SYSTEMATIC DEALER EFFORT URGED AS GREATEST NEED

Car Makers, in Reply to Questionnaire, Maintain That Regular Contact With Customers Is Business-Getter

NEW YORK, Sept. 25.—Results of a service questionnaire sent out by Automotive Daily News this week to the service departments of leading automobile manufacturers reveal that in cases where the dealers and distributors have given the service end of their work sufficient emphasis their business has held even with last year and shown increases in some cases.

Some companies report that service demand has actually increased over the record-breaking period of last year, others find a let down, and still others report business at the level in line with what could be expected in a normal year.

It seems pretty well agreed among the manufacturers that the dealers and distributors are not giving the proper attention to the service end of their business and, as one service manager points out in the following letters, their lack of business is the result of their failure to be systematic in their efforts for business rather than to a lack of service demand this year.

Following are the replies received thus far by Automotive Daily News to its service enquiries:

MARMON MOTOR CAR CO.

"In connection with the service business as it applies to us for this year, we have noticed a very decided increase.

"It is our thought, of course, that during such times as the present owners naturally have their cars repaired rather than buy new ones. The actual cash business has not increased greatly but the amount of work in the service department, due to exacting demands from the owner, has built up in volume considerably.

"We, however, have noticed that the amount of parts sales from which a legitimate profit has been derived, has been increased slightly, but not in proportion to the amount of work necessary due to the depression.

"As a whole, dealers are more

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MESKER SEES REAL GAINS IN BUSINESS

Cincinnati, Sept. 25.—A definite upward trend in business in the Eastern section of the country readily is apparent, according to Ray T. Meskel, secretary of Aluminum Industries, Inc., who returned last week from a tour through that section visiting the company's branches and jobbers in the territory.

Orders arriving at the New York branch last Monday, he said, were larger than on any single day since the branch was established there, several years ago.

"September business in all lines has started off in good shape," said Mesker. "Business men and bankers generally are cheered by the definite improvement and are confident of a steady trend toward normal conditions. This is apparent particularly in the smaller cities and towns."

At the same time a letter received by company officials from F. J. Glennon, vice-president and general sales manager, who is making a survey through the far west, reports unmistakable signs of returning prosperity, with jobbers and dealers gratified over the apparent upward movement and highly confident as regards fall and winter demand.

Richard Lewis, general manager

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Fargo Corp. Offering New Line of Motor Coaches

Special from A. D. N. Detroit Bureau

DETROIT, Sept. 25.—A new line of motor coaches is announced by the Fargo Motor Corporation, a division of the Chrysler Corporation. The new vehicles have seating capacity for twenty-one passengers, the street car coach accommodating thirty passengers standing.

The Fargo is powered by a straight L-head type engine with a bore and stroke of 3½ by 5, giving a total piston displacement of 384.84 cubic inches. It develops 120 brake horse power. A feature of the new motor coach is that the entire power plant, including engine, radiator, clutch and transmission, is quickly removable as a unit from the front end of the chassis. The engine may be removed and another installed in less than an hour's time, it is claimed. This feature reduces to a minimum time lost on account of regular engine inspection and repair.

Then, too, there is a large door at the rear of the engine compartment opening into the coach interior, permitting of easy accessibility to the power plant for repairs and adjustments. There are two bodies. One is of the parlor car type for cross country or intercity work, while the other is designed for city use. As yet no prices have been announced.

Car Makers See Profits For Dealers in Service

(Continued from Page 1)

seriously considering the service angle of their business. It has meant, in a large number of cases, the only source of revenue of any consequence which they have had this year. Naturally, their efforts toward that end would be increased to take care of the expense of maintaining their organization. Whether this is a permanent attitude or not we cannot say. However, as a case of necessity it has been necessary for them to more directly center their efforts on service.

"LEE CAIN,
"Service Manager."

DODGE BROTHERS' CORPORATION

"From our viewpoint, the service business of the industry has shown a healthy increase, this being attributed to the fact that automotive dealers are beginning to realize that service, with its added business in parts, accessories, oil and grease, offers a very good return.

"Dealers are also recognizing the fact that the shop is the hub of their business, and with this thought in mind are concentrating their efforts in the development of added service facilities.

"As a whole, we believe that the majority of dealers are going after service with a lot of enthusiasm, they now recognizing the profit possibilities from this department of their business.

"W. R. BAMFORD,
"General Service Manager."

CADILLAC MOTOR CAR COMPANY

"We find in Cadillac service that the volume of service sold by distributors and dealers depends more upon their systematic effort in maintaining regular contact with their customers than fluctuations in general business conditions. The variation of one dealer from another in this respect is considerable and overshadows any hypothetical result, favorable or unfavorable, due to the depression.

"From all we can determine, the situation with respect to service sales is about normal.

"W. A. HOUSER,
"Service Department."

PACKARD MOTOR CAR COMPANY

"The situation has been spotty. On the whole our service volume has been slightly lower than last year. At some points more business has been done and at other points less. The service organization which have been wide awake and have realized that service must be merchandized—a thing we keep constantly urging on them—have done a normal volume of business. Our factory parts sales have been very little less than last year and we have been more than satisfied with the results.

"The thing which is needed most in the service end of the automobile business is the realization on the part of the distributing organization that the huge volume of repeat business is so vitally dependent upon the satisfaction of the owner with his car and the service he receives on it; and the emphasis should be placed on the service almost more than on the car. A mediocre car with excellent service behind it will find the owner repeating while an excellent car with poor service will find owners slipping away when the time comes to replace the old car.

"Too many dealers and distributers are spending too little time in their service departments and too little time on personal contacts with their owners. They have too little accurate knowledge as to whether their owners are satisfied or not with their cars and the service they are receiving. Too many dealers and distributers are merely glorified salesmen with little or no interest in service, and too many service men are glorified mechanics with little or no interest in sales. These two extremes must be brought closer and closer together for the success of any distributing organization.

"A dealer can stay in business with excellent service and no salesmen, but no dealer could stay in business who was not prepared to render service, no matter how good his salesmen might be.

"It seems to us that the automobile business is not very different than any other matter of human relations. It is a perfectly common sense proposition of delivering a product which justifies the purchaser in his investment and then seeing that that product continues to be as good as it was supposed to be through the service it renders to its owners. An honest product intelligently sold and serviced with real interest to the owner's satisfaction—what could be more fundamentally simple? And yet how many, many dealers and distributers seemingly fail to recognize the truth.

"I would much rather sit and talk to you about these things than attempt to put these few thoughts on paper—there is so much to be said.

"J. F. PAGE,
"General Service Manager."

PEERLESS MOTOR CAR CORPORATION

"We send out a monthly magazine to our distributor and dealer organization that is called the Peerless Eagle. In this magazine the writer is given a column, and has stressed the importance to our distributor and dealer organization of going after service business to the utmost. For your information we are sending you the last three magazines, which will give an idea of just what we are doing to stimulate service sales.

"By making a comparison of parts ordered for 1930 with 1929, the total number of orders received is approximately the same, the tonnage, however, is considerably reduced, and instead of distributors and dealers ordering 25 or 50 of some particular part, they are cutting this down approximately in half. In fact, it looks as though there is a general policy to reduce the parts inventory as much as possible.

"We have in our employ Mr. Hill, who has been out in the territory for us for the past two months, spending time with each branch and distributor in educating the service salesmen to sell complete service as far as possible. In other words, we are endeavoring to sell the owner on the idea that complete service should be rendered in the service station of our distributor or branch, rather than patronize outside service stations. Believe that you will agree with the writer, however, in the statement to the effect that the modern or one-stop service stations that have been erected by Standard Oil, Firestone and other large companies, would naturally interfere with the service of a distributor or branch.

"It is our opinion, however, that a distributor or dealer appreciates the fact that it is necessary that he get as much service work as possible in order to survive. Our most successful distributors and dealers are the one that have built up a good service business, and during the past few months, when new sales have been considerably off, they have still been able to show a profit. On the other hand, those distributors and dealers that have neglected building up their service to a point where it was profitable have fallen by the wayside or have placed themselves in such a position that they are not financially able to continue in the automobile business.

"The factory has sent to distributors and dealers suggestions for letters to be mailed to their owners for the purpose of selling them on the idea that all of their service should be done in our own service station, for we have made a study of the different kinds of lubricants that were most suitable for our particular automobile, but on the other hand, unless a distributor and dealer goes to considerable expense in securing equipment, the public is looking for the cheapest place.

"J. T. NICHOLSON,
"Service Manager."

PIERCE-ARROW MOTOR CAR COMPANY

"Unfortunately, when conditions such as we have had this year prevail, there is always a general letting down and therefore every one suffers in proportion.

"The amount of business passing through the service stations does not indicate any great amount of effort on the part of the distributors and dealers to take advantage of the opportunity that has been presented.

"Service is a commodity and should be sold the same as any other commodity.

"Until service receives the recognition that it deserves the volume will not meet our expectations.

"F. J. WELLS,
"General Service Manager."

"I have read some of the excerpts from Mr. Reeve's address before the Automotive Service Association in New York and agree heartily with his ideas.

"Service selling has been greatly neglected in the automotive industry. It is still looked upon as somewhat of a necessary evil to sales.

"Dealers' service work this year has been very satisfactory. For the most part they show an increase over 1929. The total parts volume shows a slight decrease over 1929. This is in keeping with our experience, i. e., our total parts sales follow rather closely the new car sales.

"If dealers service selling were properly organized, service sales could easily have been increased 30 per cent. to 40 per cent. during the past twelve months. I believe that is estimated very conservatively when we consider that practically all of the service work now enjoyed by dealers simply comes in to the service station, with no effort made on the part of the dealer to get the work.

F. J. LEYERLE,
"Service Manager."

THE NASH MOTORS COMPANY

"We take pleasure in informing you that our parts business has not decreased during the present period to any appreciable extent; in fact, for the first six months of 1930 as compared with the first six months of 1929 the decrease was only a matter of between 14 and 15 per cent., this applying to parts.

"Our service organization in the field have been working very diligently along the lines of maintenance work and they have no complaints to offer. They have been keeping their work up to the maximum by the use of 'direct by mail' advertising, frequent contacting with the owner and following out the various recommendations which we make from time to time toward owner satisfaction and contact with the owner.

L. L. VIRGIL,
"Service Manager."

BROSSEAU URGES STATE RECIPROCITY ON MOTOR TRAFFIC

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recommended, it being pointed out that any added expense from their maintenance was more than reimbursed by consequent speeding up of traffic.

The aviation section held a spirited debate on the use of inland waters by seaplanes and a resolution was read calling for "unrestricted use of public inland waters to be permitted when not in conflict with the Department of Commerce." Other recommendations called for state and local air legislation to conform in essentials with Federal air policies. It was also urged that weather reporting be considerably extended and air markings developed by Federal authorities, state and municipal bodies and that the government continue its present policy of co-operating with the air industry. Further recommendations were to the effect that states be encouraged to appropriate funds for the development of airports, airways and other equipment.

SPARKS from DETROIT

Detroit's New Tunnel

* * *

Testing Safety Glass

* * *

Speeding Slow Pokes

Chris Sinsabaugh—Detroit Editor

WHEREAS, the Holland Tunnel under the Hudson River connects two states, New York and New Jersey, we out here in Detroit are going to go that one better in about another six weeks. We are going to have a vehicular tunnel which connects two countries, Canada and the United States. Until England and France get together and build the tunnel under the Channel, we Detroiters ought to reign supreme in this matter.

That this country-to-country subway is rapidly nearing completion was brought to our attention last week when the Graham-Paige people achieved the honor of sending the first passenger car through the tube from Detroit to Windsor, thus making history. The car was one of the new eights, and carried its four passengers from the United States to Canada with the greatest of ease. The house warming of the tunnel was followed by the announcement that it is hoped to have the formal opening about the middle of November.

This great tube of ours is going to be able to accommodate about 1,000 cars an hour. It is about a mile in length, about half of that distance under the river bed. The roadway is about twenty-two feet in width, and fresh air will be pumped into the tunnel by great fans located at each end, with a combined capacity of 1,500,000 cubic feet per minute. The lighting system consists of 600 light boxes sunk in cement at a point where ceiling and walls join. Traffic will spread out fanwise entering and leaving to facilitate customs and immigration inspection. The tunnel has been in course of construction for three years.

* * *

THE safety of safety plate glass was demonstrated in a novel way the other day by Graham-Paige, which uses this glass throughout all its sixes and eights. Taking advantage of the Philadelphia Athletics being in town, the factory coaxed Lefty Grove, Mack's pitching ace, to demonstrate the worth of this type of glass. Grove stood only a few yards from his target, the windshield of a Graham-Paige. He hurled three balls in all, each hitting the mark but failing to go through the glass. While all three panes of glass cracked evenly, there was no flying glass or harmful splinters to injure the onlookers. Then Grove tried out ordinary plate glass and his smoke ball is said to have gone through, sending a shower of glass in all directions.

* * *

SLOW pokes are going to be driven from the middle of the road by the Detroit police. There is the necessary ordinance on the books, but it has been more or less a dead letter. Now the police have been prodded by their inspector and the traffic court judge has promised to do his stuff when the cases come before him. The police have been given instructions to get after slow drivers, and if they will not pull over to the right arrests are apt to follow. The judge has agreed to deal severely with the obstinate ones, and it is thought this crusade is not only going to speed up traffic, but reduce the number of accidents.

M. E. A. MANAGER SEES UPTURN IN BUSINESS

(Continued from Page 1)

covery of normal business activity in this country, and consequently abroad this year, except the persistently passive open-market policy of the Federal Reserve Banks and the inertia or organized business leadership.

Other speakers include A. L. Viles, general manager, Rubber Manufacturers of America; Bond Geddes, executive vice-president, Radio Manufacturers Association; Ernest F. Dubrul of Cincinnati, general manager, National Machine Tool Builders Association, and William M. Carpenter, economist, National Electric Light Association.

Dr. Frank M. Surface of Washington, D. C., assistant director, Bureau of Foreign and Domestic Commerce, Department of Commerce, spoke at a session of the executives of food industries. Assistant Chief P. B. Dunbar of Washington, D. C., of the food, drug and insecticide administration, Department of Agriculture, was another speaker.

A feature of the convention was an "international dinner" Wednesday evening at Niagara Falls, N. Y., at which the Hon. Samuel J. Frame of Toronto presided. The Hon. William G. Martin, minister of public welfare, Province of Ontario, was the principal speaker.

The relations of professional, technical and service associations to trade associations were touched intimately Thursday morning by C. L. Warwick of Philadelphia, secretary-treasurer, American Society for Testing Materials, and P. G. Agnew, secretary, American Standards Association.

Other speakers today included N. J. Biddle of Detroit, general manager Allied Construction Industries; Edward Balestier, Jr., director of trade group, National Association of Credit Men; David J. Woodlock of St. Louis, manager-treasurer National Retail Credit Association, and Roscoe R. Rau of Chicago, manager-director, National Retail Furniture Association.

'Book of Facts' Boosts Ford Sales

A. F. Blangey Motor Co., Inc., Seattle, Well Ahead of 1929 Business; Gives Personal Bond With Used Car Sales.

By D. M. TREPP

WITH the present year proving a better one in the used car field in the Northwest than any previous one, the A. F. Blangey Motor Company, Incorporated, Ford dealer, Seattle, Wash., maintained not only the proportionate increase but stepped well ahead of it. This was due largely to evolving its "Book of Facts" sales plan last May. Immediately there was a noticeable spurt in buying. The book was advertised in the daily papers with a bang, and quickly those in the market for a used car were informed of the Blangey plan, with its "Guarantee Bond," based on the "Book of Facts."

Here is the way sales have run since this system went into use: May, 44; June, 51; July, 64, and August, 53. September is going like a 55-car month.

As this is written the company has twenty-seven used cars on hand. It plans to turn its entire stock twice each month, **and has been doing so.**

The highest number in stock at one time since last May was 46 and the lowest 21. Right now a shortage is impending and the department is in the market to pay cash at the right price for a few cars. But this is unusual and trade-ins are relied upon to keep up the stock to normal.

Always one price, with the price plainly marked on the cars, no code or "blind" prices or marks being permitted, is another success feature of Blangey's.

"We price the car right, and to do so we first of all buy it right," is the declaration of W. A. Wallace, new and used car sales manager. "Of course, a slow-mover may have to get a price readjustment, but we are keeping the stock clean and moving well, by careful buying, repairing, advertising, and then having some good closers on the employee staff."

* * *

WHAT price is to be allowed on a used car is figured "backwards." That is, it is visualized what the car will sell for readily, when put in first class mechanical and appearance condition. If that figure is $300, the examination first made checking every detail, to estimate the cost of putting the car in shape to come under the "Book" plan of sales, arrives at the cost for this work. To this is added overhead, commission and advertising. This total is subtracted from the $300, and a reasonable amount is further deducted as profit, so that the result is amount that is offered owner for his used machine. If this figures $226.50 that is the allowance made. The price is not fixed at $225 or $230, but is quoted exactly as it figures. The firm's policy is not to change from the offer thus arrived at. It is principle with them, just as sticking to the one price principle.

"How does the car look when put in shape and what will the public pay are the two things we must fix at the start," declared Wallace. "That is the meat in the cocoanut."

Many times Mr. Blangey's firm makes the deal even when a higher trade-in allowance is offered elsewhere. For example, the other day a $60 higher offer was given a car owner by a Ford dealer near the Canadian border. Then it took salesmanship to hold the sale at Blangey's. The service and quality of work done by the firm over a period of years was considered. This particular owner had done business here before.

"Can you think of any time when you were not given just what you wanted? Was there any time that you had a complaint against us?" When the answer was "no" to both these questions, the deal was closed.

A TRUE STATEMENT OF THE
HISTORY AND MECHANICAL CONDITION
Of The Used Automobile Described Below

Make of Car_____ Motor No._____ Serial No._____

Model_____ Year_____ No. of Cylinders_____

Previous Owner_____

Address_____ Phone_____

History

Mechanical Condition

Motor_____

Carburetor_____

Transmission_____

Clutch_____

Brakes_____

Front Axle_____

Rear Axle_____

Drive Shaft_____

Universals_____

Starter_____

Battery_____

Ignition_____

Sale price_____ Down payment_____

Used Car No._____ Monthly payment_____

A GLANCE INSIDE THE BOOK

Naturally $10, $15 or $25 differences in allowance are more easily overcome, and along same line of argument.

So it is that reputation plays a big part in closing deals. The reputation of A. F. Blangey was good before he adopted the "Book of Facts" guarantee. It was good when he first became manager of the Central Agency, in 1920. It was one of the original six Ford dealerships in Seattle. A few years ago the name was changed to its present one, in line with Ford policy of dealers using their personal names in firm names.

* * *

IN May, when Wallace stepped in as used car head, the management looked about for some kind of a guarantee plan. Other firms galore were using similar plans with catch names. Finally, an advertising agency suggested the "Book of Facts." This is printed as a four-page leaflet, 5x7 inches in size (per page). The first page bears the title, and under it, "The Truth, the Whole Truth and Nothing But the Truth." The inside pages are used for "a true statement of the history and mechanical condition" of the car concerned. Items include make of car, motor number, serial number, model, year, number of ylinders, previous owner (address and phone); history (as far as known is definitely stated); mechanical condition as to motor, carburetor, transmission, clutch, brakes, front axle, rear axle, drive shaft, universals, starter, battery, ignition; sale price, down payment, monthly payment and used car number. These statements are then guaranteed with a signed bond, that is placed on the fourth page of the leaflet or "book," as it is called. This is signed and executed before a notary public by President Blangey, himself. This guarantee attests the truth of every statement made. The bond reads:

"This bond is the personal guarantee of the undersigned, attesting the truth, the whole truth and nothing but the truth of the statements contained in this 'Book of Facts' as to the age, mileage, previous ownerships and mechanical condition of the used automobile described herein, to the very best of obtainable knowledge, together with the itemized particulars concerning the reconditioning of the said used automobile before it was offered for sale. This bond guarantees that if, within ten days from date hereof, the said used automobile, after normal use, should prove unsatisfactory in any way, this company will, at any time within said period, take back said automobile and the full amount paid therefor will be credited to the purchase of any other used or new automobile in stock. This bond further guarantees that if within thirty days from date hereof any part of said automobile, after normal use and service, should prove mechanically defective, this company will, at any time within said period, repair said automobile free of charge."

* * *

THE buyer likes to get a document of this kind. It helps sell. It somehow carries confidence and good will.

Mr. Wallace keeps his own used car record, which is compact and complete. Across two pages of a ledger he carries the data as follows: Used car number (this number adopted locally when car is received in stock), number of receiving slip which has been sent to the office as a cash item, man from whom purchased, motor number of car, license number, type of body, cost, reconditioning expense, date taken in, record of man buying car; salesman who sold it. This is an accurate check, looked over at a glance. The slow sellers stand out like a sore thumb on these pages.

HOUSE ORGAN MAILED DIRECT TO CONSUMER CREDITED WITH INCREASING SERVICE BUSINESS

Lawrence Motor Car Company, Auburn and Cord Distributor, Mingles Personalities With Its Service Chats

THE Lawrence Motor Car Company of Newark, N. J., distributor of Auburn and Cord automobiles, has increased its service volume with the aid of the "Lawrence Co-operator," a monthly good-will builder, edited by J. Alden De Ronde. This direct mail effort has not only sold service, but has had a great deal to do with sales of new and used cars. A feature is the use of the names of the different department heads building up a personal contact for customers who always like to go to the head of the department.

J. K. Lawrence, sales manager, over his own signature in the September issue of the Co-operator, writes:

EXTRA!

We announced in a previous issue of the Co-operator the appointment of Mr. William Scheidt as our new service manager.

Mr. Scheidt will attend to all matters pertaining to Auburn and Cord service in an efficient and courteous manner.

With this change we have adopted a free inspection policy on all cars brought to our service station.

This includes checking ignition, carburetion, clutch pedal and brake pedal.

We wish to remind you of the importance of having your Auburn serviced at an authorized Auburn service station in order that you may be assured of obtaining nothing but standard Auburn parts—and factory adjustments on replacement parts.

We employ in our service station the most capable specialists obtainable in ignition carburetion, hydraulic brakes, as applied to Auburn and Cord and other lines of work requiring the utmost skill.

Pending arrangements for a new dealer in East Orange, we will render service on all cars bought from East Orange Auburn Company, on which the ninety-day warranty policy has not yet expired.

J. K. LAWRENCE.

* * *

THE editor of the Co-operator believes that is is persistency that finally gets results. But it must be persistency prompted by a desire to do a good job in a way that will benefit the greatest possible number of people.

Each month the company offers a special repair job. The September offer, played up on Page 1 of the Co-operator, was described as follows:—

SPECIAL OFFER
for
SEPTEMBER.

Adjust Valves,
Adjust Brakes,
Adjust Carburetor,
Tighten Throughout,
Lubricate Entire Car.
Wash and Simonize.

Regular price.....$26.00
Special price..... 19.50

Saving $6.50

Then on Page 2, under the heading of "Real News," came the following:

* * *

REAL NEWS

IF WE announced that we intended to present to you a valuable painting by a famous artist, for a few cents, you would favor us with a hurry call.

We Go Further!
A Masterpiece
by a
Present-Day Artist.

Our paint shop superintendent Brother Joseph Archer, A. D. E. offers September and October specials:

Wash, touch up, simonize and redress top, regular price...$15.00
Special offer..... 12.00

Saving 3.00

Refinishing 6 wire wheels, any color, regular price.....$24.00
Special offer..... 15.75

Saving 8.25

Refinishing all fenders, splash pans, aprons, regular price..$34.00
Special offer..... 22.50

Saving 11.50

Restriping, regular price..... $8.00
Special offer..... 5.50

Saving 2.50

Refinish hood only, regular price $10.00
Special offer 7.50

Saving 2.50

Complete repaint job, regular price 135.00
Any color—special offer. 90.00

Saving 45.00

Our body department will care for all body and fender repairs.

Page 5 discusses grease and brake linings as follows:

* * *

HOW LONG

HAS the present grease been doing duty in the transmission and differential cases of your car?

It is a matter of only a few moments to have them refilled, and the expense is almost nothing.

Replace grit with grease.

REMEMBER

Not only your own life, but the lives of others depend on your brakes. Worn out brake lining may be the cause of much unhappiness. Our special September four-wheel brake lining price
$19.00
instead of
$22.00.

Staff Backs Up Blangey 'Book of Facts'

A. F. BLANGEY, president of the A. F. Blangey Motor Companuy, Inc., Seattle, near middle of second row (standing) in light suit and wearing glasses; the office help, department managers, service floor attendants; the two rows seated show the mechanics and service men. About 10 per cent. of the staff were not present when this picture was taken

Automotive Daily News

"Of, By and For the Entire Automotive Industry"

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AUTOMOTIVE DAILY NEWS PUBLISHING CORPORATION,
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FRIDAY, SEPTEMBER 26, 1930

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1930 Production

IN a recent issue of The Automotive Daily News there was printed an estimate of 1930 production, based on the output for the first eight months of the year. According to careful analysis, the best figure for the present twelve-month period that we can reach is about 3,750,000 vehicle units. This includes domestic and Canadian production and vehicles built for the export market. At the beginning of the year authoritative estimates placed the 1930 production at about 4,200,000. Since then many things have happened to alter the course of industrial activity.

Granting the reasonable accuracy of the estimate of 3,750,000, our production this year will be off 33 per cent. from that of 1929, which totaled 5,621,709. It will compare with the 4,601,141 vehicle units manufactured in 1928. We have to go back to 1927 before we get a yearly production below the figure that we shall achieve in 1930. The 1927 total vehicle output was 3,580,380.

This 1930 production, however, is more than a mere dropping of output to meet economic stringency. It is the redemption of a promise, made or implied by the manufacturers to their dealer organizations, to let production follow demand, instead of letting production run riot, while dealers strove despairingly to create demand.

When 1931 rolls around the automotive industry should be found in about as completely liquidated a condition as it is possible for a business to reach. Dealer stocks have been dropping month after month during the present year. The buying season next spring will find dealers generally ready to profit immediately from the orders they will get.

If the lesson of 1930 sticks in the automotive industry, we may some day look back on this year of grace as the most useful we have enjoyed or endured.

Price Stability

ONE branch of the great automotive industry which has probably suffered more from the uncertainty of prices of its raw materials is that which gives us our tires and tubes. During the past few years, partly due to the intervention of the British restriction scheme, the price of rubber has bounced around in a manner that was calculated to put users of the product in a frenzy. Did a manufacturer form the opinion that crude rubber had reached a bottom price and commit himself for purchases to cover some months' needs, this elastic substance promptly dropped to new levels of price depression. On the other hand, if the unfortunate user figured on lower prices and did not get sufficient stock in hand, rubber bounced out of a price slump and soared skyward. The numerous red ink notations in the tire field could be traced to this source.

Not long ago Sir Eric Geddes, chairman of the Dunlop Plantations Company of London, announced that his organization was producing rubber that costs less than 8 cents a pound in Singapore and expected soon to reduce this base to 6 cents per pound.

Sir Eric stated that the present overproduction of rubber was due to the Stevenson restriction act, which had encouraged enormous production of rubber under Asiatic ownership. Asiastic producers must get a minimum of 17 cents per pound to show a profit in the London market.

The 8-cent rubber, which Sir Eric Geddes talks of, has been made possible by scientific management, mass production and the other weapons of big business. The small Asiatic producers cannot meet this competition. From all of which it seems hopeful that eventually crude rubber prices will be stabilized, so that manufacturing users will not have to embark in a gambling venture every time they make a commitment to cover future needs.

Scaling of Steel at Forging Temperatures

By W. E. JOMINY
D. W. MURPHY

One of the metallurgical factors involved in heating steel for forging is the scaling of the steel. This scaling, which is more or less taken for granted in any forge shop, is really more of a factor than is usually realized. It is not always appreciated that scaling enters definitely into a number of items of cost other than the mere loss of metal and, further, that scaling is an important cause of a number of undesirable qualities in the finished forging. A consideration of the following facts will give some idea of the difficulties resulting from the presence of scale and of the added costs of finished forging due to scaling:

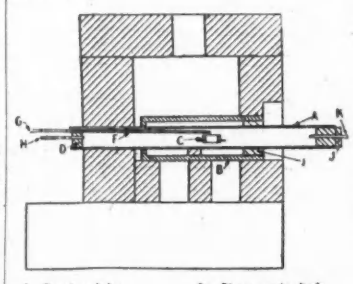

A - Porcelain tube
B - Carborundum muffle
C - Sample
D - Fire brick plug
F - Thermocouple protection tube
thermocouple inside
G - Thermocouple leads
H - Gas inlet from flow meter
I - Front muffle brick
J - Brick to close tube
K - Gas sampling tube to siphon sampler

Fig. 1—Diagram of Gas Furnace Used in Scaling Tests.

1. Scale from steel reacts with most refractories to form a relatively low melting compound. This reaction greatly shortens the life of furnace floors and other refractories with which the scale may come in contact.

2. Scale from the steel occupies space in the forging dies, and results in parts with wrong dimensions. It can be and often is scraped off before forging, if excessive, but this process requires additional labor.

3. Scale formed on steel causes a loss in the weight of steel, and therefore causes an economic loss equal to the value of the steel transformed into scale.

4. Scale on steel sometimes causes sticking of the forging in the forging dies. This, of course, causes increased labor costs.

5. Scale on steel sometimes gets pounded into the forging, causing weak spots in the forging and points at which cracks develop easily. This embedded scale also sometimes causes machining difficulties.

6. Most forgings must have the scale removed before the forging is machined or used. This removal of the scale, whether by pickling, tumbling or shot blasting, is more expensive the deeper and more adherent the scale.

It is evident that the presence of scale in a finished drop forging which results from the action of the atmosphere in the forging furnace seriously affects its quality and adds considerably to its cost. This investigation was undertaken in order to make a study of the phenomena of scaling of steel at forging temperatures in the hope of throwing some new light on the principles involved, with the ultimate objective of improving the method of heating forgings.

Previous Work

No previous work apparently has been carried out on scaling at temperatures around 2,300 degrees Fahrenheit.

Other investigators have conducted tests on the scaling caused by air, water and carbon dioxide up to 1832 degrees Fahrenheit, but did not state in their reports the rate of flow of the gases. This rate of flow has an appreciable effect on the rate of scaling when the rate of flow is small. The lack of this information, therefore, in the results reported by these investigators limits the possible applications of their data.

The study was limited to the action of the gases: carbon dioxide, steam, oxygen and air on steel at forging temperatures.

The steel used in the test was ½-inch round S.A.E. 1015 steel. The temperatures at which tests were made varied from 2000 to 2500 degrees Fahrenheit, and the periods of exposure varied from 5 to 160 minutes.

In conducting the tests a sample of steel was placed in a tube through which the gas to be investigated was passing at a given rate and which had been previously heated to the desired temperature. The steel was allowed to be exposed to the conditions of the tests for a predetermined period of time, after which the steel was removed from the furnace and dropped into cold distilled water to stop the reaction quickly and to split off part of the scale. The remainder of the scale was removed by electrolytic pickling. The steel sample was carefully weighed on an analytical balance before it was placed in the furnace and again after the scale was removed. From the difference in weight the loss of steel per 100 square inches of surface exposed was calculated.

Before any scaling tests could be made, it was necessary to develop a method of removing the scale from the steel. The method which proved most satisfactory consisted in quenching the steel in water at the end of the heating, which not only split off most of the scale but also stopped the scaling reaction quickly. However, all of the scale does not come off when the sample is quenched in water so that the sample must be treated further in order to remove the remainder of the scale. The removal of this remaining scale was found to be best accomplished by means of an electrolytic pickling bath, using a lead anode and making the specimen the cathode, using a 4 per cent. solution of sulphuric acid in water and a potential difference of three volts. A blank of similar size and surface was immersed in the same solution with the specimen and carefully weighed before and after the pickling action. The sample was pickled in this solution for a period of time from fifteen minutes to three hours, depending on the type of scale, the average time being about forty-five minutes. The blank placed in the solution with the steel seldom lost more than two milligrams in weight, indicating that the amount of steel dissolved in the pickling solution was practically negligible.

The scale was filtered from the distilled water into which the sample was quenched and weighed. To this weight was added the scale which came off in the electrolytic pickling bath. The scale which dissolved in this bath was then also determined. By adding these three values, it was possible to determine the weight of scale removed which could be compared with the weight is open to some slight objection due to the reaction of the steel at forging temperatures with the water.

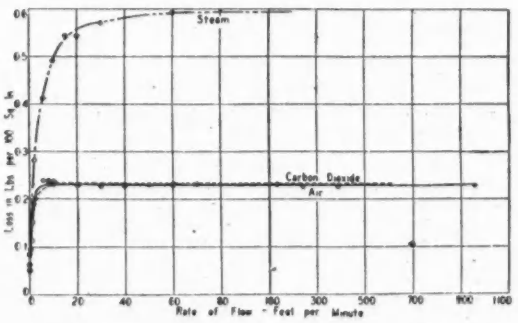


Fig. 2—Curves Showing Effect of Rate of Flow of Oxidizing Gases on Scaling of Steel.

This reaction is known to produce scale, although, since the time of cooling is very short, the amount of scale produced is small. Another disadvantage is that the steel sample travels through air for a fraction of a second before it becomes immersed in the water. For these reasons, a few tests were made in which the steel sample was quenched after heating in an atmosphere that would produce no scale and the amount of scale found on the steel after quenching was measured. This was found to be about 0.003 pound per 100 square inches of surface. However, when the sample is coated with scale, as it was in all the tests, this scaling due to brief exposure to air and water is probably very much less.

The furnace used for the tests consisted of a gas-fired muffle furnace through which was placed a forcelain tube with glazed finish on the outside. Fig. 1 shows a diagrammatic sketch of the furnace and furnace equipment. The longitudinal placing of the sample in the tube was such that the bead of the thermocouple was at about the middle of the steel sample and about ¼ to ½ of an inch from the sample.

Before making a test, the gas to be used was always permitted to flow through the tube for a period of about twenty minutes, after which an analysis was made of the gas coming from the tube, in order to determine whether the air in the tube had been washed out by this process. If no oxygen was found in the test, the gas was considered sufficiently pure for use in the conduct of the test. The gas analyses were made with a modified Williams Orsat gas analysis equipment, the modification of the equipment being a substitution of a sample burette, which could be read more

(Continued on Page 7)

COMING EVENTS

SEPTEMBER

23-26—Chicago, Ill. American Society of Mechanical Engineers Iron and Steel Division meeting.
22-26—Chicago, Ill. American Welding Society meeting.
22-26—Niagara Falls, Ont. American Gear Manufacturers Association semi-annual meeting.
22-26—Chicago, Ill. Society for Steel Treating meeting.
22-26—Chicago, Ill. American Society for Steel Treating meeting at Stevens Hotel.
29-Oct. 4—Pittsburgh, Pa. National Safety Council Annual Safety Congress.

OCTOBER

2-12—Paris, France. Automobile Salon.
6- 7—Reading, Pa. Pennsylvania Automotive Association Convention.
6- 8—Tulsa, Okla. American Society of Mechanical Engineers Petroleum meeting.
6-11—Washington, D. C. Sixth International Road Congress.
6-11—Washington, D. C. American Roadbuilders' Association Convention.
7- 8—Detroit, Mich. Society of Automotive Engineers production meeting at Book-Cadillac Hotel.
13-15—French Lick Springs, Ind. American Society of Mechanical Engineers general meeting.
14-15—Syracuse, N. Y. New York State Dealers' Association Convention.
16-25—London, England. Olympia Motor Show.
22-24—Pittsburgh, Pa. Society of Automotive Engineers transportation meeting
11-26—Dallas, Tex. Southwestern Automobile Show.

NOVEMBER

4- 7—Chicago, Ill. National Fire Dealers' Association Convention
7- 8—Cleveland. National Battery Manufacturers Association meeting at Hollenden Hotel.
6-16—Berlin, Germany. International Automobile Show.
8-15—Chicago, Ill. Automobile Salon at Drake Hotel.
13-19—Cleveland, O. Motor and Equipment Association and National Standard Parts Association, Joint Show.
13-23—Paris, France. Commercial Vehicle Salon.
14-15—Los Angeles. Western Motor Clubs conference.

DECEMBER

6-17—Brussels, Belgium. Automobile Exhibition.

JANUARY

3-10—New York. National Automobile Show.
8—New York City. Society of Automotive Engineers' annual dinner.
10-16—St. Louis, Mo. National Roadbuilders' show and convention.
17-24—Detroit, Mich. Annual Show, Convention Hall.
19-23—Detroit, Mich. Society of Automotive Engineers' annual meeting.
24-31—Chicago, Ill. National Automobile Show.

FEBRUARY

7-14—Los Angeles, Cal. Automobile Salon.
16-20—San Francisco. Society for Steel Treating National Western Metal and Machinery Exposition.
21-28—San Francisco, Cal. Automobile Salon.

MERCHANDISING ACCESSORIES EQUIPMENT **WHOLESALE** DISTRIBUTION SHOP EQUIPMENT REPLACEMENTS

NATIONAL CREDIT OFFICE COMPLETES JOBBER SURVEY

Slower Turnover of Working Capital in Jobbing Industry Noted as Result of Expansion

By M. H. STOCKING

CLEVELAND, Sept. 25.—A slower turnover of working capital in the automotive jobbing industry than was the case a few years ago is indicated by a study recently completed by the National Credit Office, with headquarters here. This is believed to be indicative of a growing tendency on the part of jobbers to open branches.

About 55 per cent. of all jobbers are shown to be good credit risks in varying degrees. In another group constituting 35 per cent. of all jobbers financial strength is less evident, although the records reveal that this group maintains the best collections, a forty-day average period bettering the average for the industry, which is slower than the generally accepted standard of forty-five days.

The average collection period in the automotive jobbing industry is forty-eight days. Annual inventory turnover is 2.8 and turnover of net worth 3.17. Net profit on sales averages 4.57 per cent.

Somewhat surprisingly, jobbers with the highest credit rating are not the best money makers. In fact, they are at the foot of the list.

About 10 per cent. of the 4,000-odd jobbers included in the National Credit Office's survey are shown to be hazardous credit risks. The absurdity of selling to this group merely for the purpose of obtaining distribution, says the survey, is apparent from the fact that the creditors have slightly more at the risk of the business than the stockholders.

Figures upon which these and various other conclusions are based were obtained through an analysis by the automotive division of the National Credit Office of the financial statements of 4,177 jobbers (branches excluded) throughout the United States and Canada. Of these, however, 714 appear as exclusive distributors of radio equipment, while 917 handle radio equipment in addition to automotive and other lines. Most of the conclusions apply only to automotive jobbers.

"A great deal has been written," says the survey, "in an effort to help the jobber move his merchandise, to properly budget his expense and to function in accordance with the necessities of the manufacturers whose lines he stocks.

"Yet few manufacturers have ever thoroughly analyzed the statements of prospective or actual customers in an effort to defintely determine the factors which make one jobber a safe and valuable medium of distribution while establishing another as a failure."

The National Credit Office, in making this survey, used the list of 4,177 jobbers covered by its monthly report showing detailed information concerning each of these jobbers, including the number of salesmen, average inventory and annual volume, association or associations with which affiliated and the credit classification of the jobber.

In the analysis of financial statements a considerable number were reduced to common size or percentage basis. From the list of 4,177, fundamental differences are brought out in the following five-way classification:

No. of Jobbers.	Per cent. of total.	Rating.	
234	6.3	A	Entitled to requirements
762	18.3	B	Entitled to reasonable requirements
1,252	30.0	C	Fair risk for moderate amounts
1,471	35.0	D	Caution necessary
428	10.3	E	Hazardous credit risks
4,177			

The average statement for the industry was built up by multiplying each percentage item of the common size statement of each classification by the percentage of jobbers of each classification named in the survey.

"The fact that the current ratio in all but the 'E' jobber is above the generally accepted standard indicates the fallacy of depending on this factor only in making a credit decision.

"A comparison of quick assets and quick debt discloses that the 'D' and 'E' accounts do not have sufficient cash and receivables to meet current liabilities.

"Since the working capital of both 'D' and 'E' accounts is exceeded by the inventory, it is reasonable to question the investment in merchandise which is turning only at the rate of 134 and 153 days, respectively.

"The slower turnover for these classifications tends to lower the average for the industry to more than a point below the four times annually, which was generally accepted as standard several years ago. This slowing up in the average for the industry may be indicative of the growing tendency on the part of jobbers to open branches."

Important ratios brought out by the survey are shown in the accompanying table:

The survey points out that "A," "B" and "C" average statements indicate a good current ratio with a tendency to increase the amount invested in inventory at each decline in the classification. That the inventory turnover of the "A" acounts is only 3.7 times annually, whereas the "B" and "C" accounts stand at 3.8, is accounted for by the fact that the "A" account is, in the majority of cases, a jobber of light hardware with many more lines than the "B" and "C" accounts.

"In the case of many 'D' and 'E' accounts," says the survey, "it is even suggested that no physical inventory may have been taken recently, and the excessive merchandise item represents physical inventory plus the loss on obsolescent goods, which may or may not have been sold.

"The worth to debt comparison for the favorable classifications is better than the average for the industry and the ratios serve to point out the unsatisfactory condition of the 'D' and 'E' accounts, particularly the latter, where control has been lost. Of necessity the 'D' and 'E' accounts are forced to borrow from the banks, in the majority of cases their full line, and secure the help of trade creditors in carrying heavy inventories. Velocity of sales must be improved for it is problematical whether additional capital could be interested, although a retirement of a substantial portion of the indebtedness would certainly tend to strengthen the security of the trade creditors."

In the "D" classification it is suggested that a large percentage of assets invested in slow turning receivables indicates either time sales or credit leniency. The nominal investment in fixed assets by the "D" jobber immediately suggests, says the survey, that information be secured as to the rent paid. On the other hand, the heavier average investment in fixed assets of the favorably classified jobbers indicates that they are competitively under heavier overhead expense because of the larger percentage of fixed assets mortgaged, larger bank loans and loans from other sources, and a larger amount of preferred stock outstanding.

The accompanying table, showing important ratios, reveals that the "A" group of jobbers obtains a net profit on sales of only 3.03 per cent., which is lower than that obtained by the "E" or "hazardous credit" group. "Profit on sales may be termed satisfactory," concludes the National Credit office, "only in the case of the 'B' and 'C' accounts. These two groups show profits of 6.3 and 5.74 per cent., respectively, against a weighted average of 4.57 for the industry.

IMPORTANT RATIOS

	A	B	C	Weighted Average All Automotive Jobbers	D	E
Average Net Worth	$335,750	149,850	63,900	82,800	35,849	21,070
Total Assets & Total Liabilities	$395,000	185,000	90,000	120,000	56,000	43,000
Average Sales	$762,150	412,590	196,816	234,750	126,875	74,375
Turnover of Net Worth	2.27	2.76	3.08	3.17	3.54	3.53
Average Net Profit on Sales	$ 23,090	25,995	11,300	10,730	4,240	2,385
% Net Profit on Sales	3.03%	6.30	5.74	4.57	3.34	3.21
% Profit on Net Worth	6.90%	17.30	17.70	13.00	11.82	11.30
Current Ratio	6.50	4.74	3.20	2.80	2.42	1.59
Working Capital	229,495	108,780	46,080	60,480	26,492	12,384
Quick Assets to Quick Debt	3.12	2.20	1.55	1.10	.81	.57
Turnover of Working Capital	3.32	3.80	4.25	3.90	4.76	6.00
Collection Period (Days)	46 days	44 days	44 days	48 days	40 days	51 days
Annual Inventory Turnover days	98 days	94 days	95 days	128 days	134 days	153 days
Annual Inventory Turnover times	3.7×	3.8	3.8	2.8	2.7	2.5×
Net Worth Rep. by Fixed Assets	31.5%	21.8%	25.0%	25.0%	15.4%	35.2%
Net Worth Rep. by Quick Debt	12.6	19.4	32.8	40.7	55.5	98.0
Net Worth Rep. by Total Debt	17.6	23.4	41.0	45.0	55.6	100.4
Working Capital Rep. by Inv.	61.3%	67.5%	77.5%	94.0%	116.2%	94.0%
Inventory Rep. by Quick Debt	30.0	39.8	58.5	59.5	62.5	59.5%

Editor's Column

WHOLESALERS who sell to the retailer first and then to the retailer's customers at wholesale are not only injuring their trade but their own business as well.

This unethical wholesaler often wonders why the retailer does not meet his obligations to him on time, and usually it is this kind of wholesaler who is the first to put a retailer in bankruptcy if the retailer finds himself in financial distress.

After being in business for over twenty-one years, one retailer says he came to the conclusion that it is the retailer's own fault, to a great extent, that this condition exists.

Retailers should be interested in the methods of distribution and the ethics of the wholesalers with whom they do business, he said. They should not patronize an unethical competitor.

Almost every wholesaler who does a retail business, and there are quite a number of them, has admitted in the course of conversation that although he sells a lot of merchandise at retail, he could not exist without the support of the retailer.

Selling to retailers enables retailing wholesalers to buy in large quantities and to retail at wholesale prices at a profit.

Every retailer should know about this, and should know the distribution methods and the ethics of the wholesale house with which he does business.

REAL ESTATE boards throughout the United States are forming property-owners divisions to work for fairer taxes on real estate. Just as soon as the preliminary organization work is out of the way there is to be undertaken an intensive research in the field of local and state taxation. The search will be based on four questions and the third of these is:

Can sales taxes be used as a method of relieving real estate?

In New York, a state-wide body of property owners is being formed, and it is announced that one of the chief purposes of the organization will be:

To relieve real estate from the present inequitable distribution of taxes.

Supporting the contention that the tax upon real estate is inequitable and unjust, it is said:

Although representing only about one-third of the gross wealth of the state, real estate has to pay more than three-fourths of the tax bill in most cities.

Probably there has never been a time, except in case of war, when more powerful arguments for a sales tax have been advanced than those now being put forward.

The proponents of the sales tax have at hand two of the strongest arguments that can be advanced in any cause: (1) Sympathy for those in distress; (2) More money in the pockets of the great army of rent payers.

Even though it should be necessary for the state of New York to fin dnew sources of revenue to keep up with the ever-increasing cost of government, this does not mean that a sales tax must be accepted. Because more money has to be raised for state purposes does not mean that legitimate business must be hamstrung; that the nose of the tax snooper must be continually in every merchant's cash register.

To sit back and talk about the injustice of a sales tax, or a luxury tax, will not get very far if the advocates of the sales tax are backed by gigantic organizations of real estate owners and rent payers.

If the merchants in every line of business fail to organize against the sales tax wave that is sweeping the country, there is good reason to believe that numerous states will be burdened with this cumbersome method of getting more money into the public treasuries.

Particularly does it behoove the automotive industry to be equipped to combat the sales tax agitation. Merchants who deal in so-called necessities, if they are organized, may be able to postpone a general sales tax by urging that sales of luxury alone should be taxed.

Battery Service Chart Published by Vesta

A condensed wall chart of battery information has been published by the Vesta Battery Corporation, Chicago.

This chart is of heavy off-set stock, 12x18 inches in size. While it was prepared especially for Vesta dealers, a copy will be supplied to any battery dealer. This chart is divided into two sections, "symptom" and "remedy." The former is divided into two groups, "The battery has not been opened" and "The cells have been opened for examination."

There are three separate classifications under "The battery has not been opened." First, battery in the car; second, on charge; third, on discharge. In each case a number is assigned to cover the particular condition of the battery.

By referring to the corresponding number of "remedy" an examination is given of the condition and the action which should be taken.

BUDD DISTRIBUTOR OPENS NEW BRANCH

Philadelphia, Sept. 15.—United Wheel and Rim Service, Inc., Philadelphia distributor for Budd Wheels, has opened a new branch at the former establishment of the Miller Wheel Service, Evergreen and Thompson Streets, Harrisburg, Pa., where it will give more complete wheel and rim service through the central section of Pennsylvania.

The branch will carry a complete stock of wheels, rims, brake drums and parts, will handle sales to truck branches and car distributors, and will cover Columbia, Cumberland, Dauphin, Juniata, Lancaster, Lebanon, Lycoming, Mifflin, Montour, Northumberland, Perry, Snyder, Sullivan and Union counties.

Wholesale Brevities

Newark, N. J., Sept. 25.—The Belden line of automotive wire and cable has been added by the following jobbers in this state: Middlesex Auto Parts Company, New Brunswick; Niles Auto Parts Company, Elizabeth; R. & C. Auto Parts Company, Trenton; Auto Gear and Axle Corporation, Newark; S. Barnett Auto Parts Company, Hoboken.

Seattle, Wash., Sept. 25.—Triangle Automobile Parts Company has just added Hastings rings to its stocks, according to Manager Wallace Cathcart.

Ardmore, Pa., Sept. 25.—The Main Line Motor Parts Company has moved into a new location which places it in better position to handle the trade, which is increasing steadily. The new headquarters are at 69 East Lancaster Ave.

Philadelphia, Sept. 25.—The Record Sales Company, jobber of automotive, electrical and battery supplies and service station equipment, formerly of 1602 Fairmount Ave., has opened quarters at 641 North Broad St.

Newark, N. J., Sept. 25.—The W. E. Pruden Hardware Company, automotive jobber, now located at 45 Williams St., is moving to larger quarters next month, according to John Knox, manager.

Seattle, Wash., Sept. 25.—Grant Auto Electric has been appointed official sales and service station for S. & M. Lamp Company, Los Angeles.

Production--Engineering--Factory-

Scale and Oxides Removed Electro-Chemically

ISSUANCE of a United States patent on the Bullard-Dunn process, an electro-chemical cleaning method for removing scale and oxides from the surfaces of metals without damaging effects, was recently celebrated by the Bullard Company, Bridgeport, Conn., in the form of a reception and demonstration. The patent was issued September 16.

The Bullard-Dunn process removes scale and oxides from metal surfaces by the action of hydrogen electrically generated on the surface of the metal beneath the scale or oxide. Protection of the surface from pitting, etching and hydrogen embrittlement is accomplished by the instantaneous coating with a lead film of the clean spots on the surface of the metal as the scale is removed.

The process does not chemically attack the cleaned surface of the original metal to cause reduction of bulk by erosion. An outstanding feature of the process is its ability to reach and thoroughly clean recessed surfaces otherwise inaccessible to such cleaning methods as sandblasting or scratch brushing. It is said to be extremely simple and the ordinary shop man can, after brief instruction, produce good results.

Economies effected in tool room use of the Bullard-Dunn process are declared important because intricate dies may be thoroughly de-scaled, easily and rapidly, after hardening and drawing or when being returned to service after storage and while being cleaned can be thoroughly inspected for hardening cracks or other defects.

In the fabrication of stainless steel or rustless iron the formation of chromic-oxide, exceptionally abrasive, is the definite but unfortunate result of each annealing operation. This oxide is particularly destructive to dies and tools. Use of the new process assures the complete and thorough removal of oxide, resulting in increased useful life of tools and dies, increase of the productive capacity of the forging or polishing departments and reduction to a marked extent of the cost of wheel-renewal.

Research leading to the development of the process began four years ago, when the Bullard company established a department for the production of automobile bumper bars. One of the problems encountered was that of removing the black heat scale formed on these parts during the tempering treatment. The parts could not be polished properly or economically until this scale was completely removed. Tumbling, sand-blasting, sand-rolling, pickling and electro-pickling were tried, but none of these processes proved satisfactory to the company.

CLARK

CLARK AXLES *and* METAL WHEELS *for commercial vehicles*

CLARK EQUIPMENT COMPANY
Buchanan Michigan

AXLES
Front & Rear
WHEELS
Single or Dual Tire
CAST STEEL HOUSINGS
TRANSMISSIONS

TODAY AT THE NATIONAL METAL CONGRESS

The following papers will be read at the several meetings of the societies taking part in the National Metal Congress in Chicago Friday, September 26:

A. S. S. T.

Nitriding in Packing Materials and Ammonia—A. B. Kinzel and J. J. Egan, Union Carbide and Carbon Research Laboratories, Long Island City.

Further Investigation in Nitriding—Robert Sergeson and H. J. Deal, Republic Steel Corporation, Massillon.

Nitriding the Larger Forgings—J. H. Higgins, Camden Forge Company, Camden, N. J.

Nitriding Furnaces and Their Equipment—W. J. Merten, Westinghouse Electric and Manufacturing Company, East Pittsburgh.

Microcharacter Hardness Tester—C. H. Bierbaum, Lumen Bearing Company, Buffalo, N. Y.

Relation of Structure to Surface Hardness of a Case Hardened Steel—H. W. McQuaid and O. W. McMullan, Timken-Detroit Axle Company, Detroit.

Recent Developments in Gas Carburization—O. J. Wilbor and J. A. Comstock, Peoples Gas Light and Coke Company, Chicago.

Modifying Action of Ferrosilicon Upon the Process of Carburization—E. G. Mahin and F. J. Mootz, Notre Dame University, Notre Dame, Ind.

Resistance of Steels to Abrasion by Sand—Samuel J. Rosenberg, Bureau of Standards, Washington.

Metastable Equilibrium in Hypereutectoid Iron-Carbon Alloys—A. A. Bates and D. E. Lawson, Case School of Applied Science, Cleveland; H. A. Schwartz, National Malleable and Steel Castings Company, Cleveland.

A. S. M. E.

Application of Metallic Recuperators to Industrial Furnaces—G. W. Mantle, Surface Combustion Company, Pittsburgh.

Continuous Reheating Furnaces for Rolling Mills—A. L. Culbertson, Rust Engineering Company, Pittsburgh.

Manual Semi-Automatic Devices for the Protection Against Wind of Ore Bridges and Similar Structures—C. O. Burton, Minnesota Steel Company, Duluth, Minn.

Notes on the Production, Purification and Uses of Blast Furnace Gases—William A. Haven, Arthur G. McKee Company, Cleveland.

Combustion of Gas in Blast Furnace Stoves—H. W. Paret, Jr., Swindell-Dressler Company, Pittsburgh.

AMERICAN WELDING SOCIETY

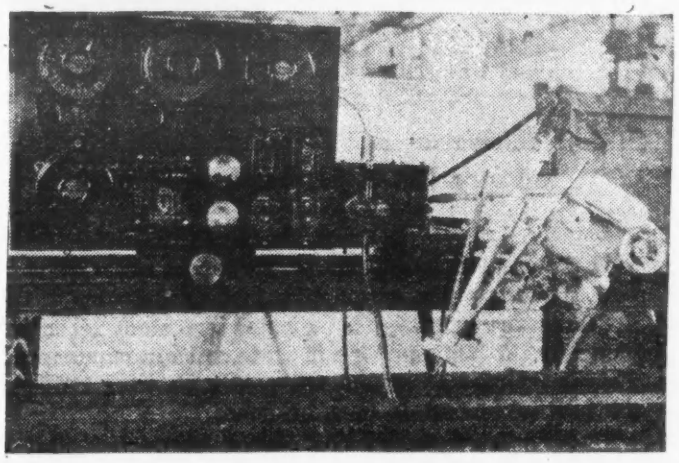
J. J. Crowe, member of executive committee, presiding.

Welding of Stainless Steel, by L. W. Hostettler, Allegheny Steel Company.

Arc Welding of Aluminum, by W. M. Dunlap (Aluminum Research Laboratories), Aluminum Company of America.

Oxy-Acetylene Welding of Corrosion Resisting Steels, by W. B. Miller, Union Carbide and Carbon Research Laboratories.

Automatic Hydrogen Welder

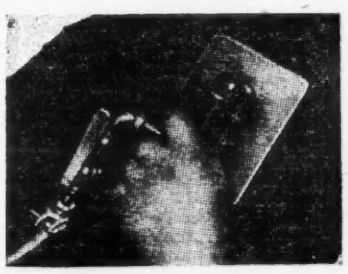


THE General Electric Company announces a new automatic welder for atomic hydrogen welding. This is the first application of automatic equipment to this welding process, previous atomic hydrogen welders being for hand welding only. The equipment was exhibited for the first time at the National Metals Exposition in Chicago this week.

PHILADELPHIA SECTION S. A. E. HOLDS SESSION

Philadelphia, Sept. 25.—The Philadelphia section of the Society of Automotive Engineers held the first meeting of the fall and winter series in the banquet hall of the Philadelphia Automobile Trade Association. E. B. Neil was chairman of the evening and the principal speaker was John A. C. Warner, general manager of the society.

VIBRATION MACHINE SPEEDS RADIATOR CLEANING



Solvo vibration machine applied to radiator core

A HAND type vibration machine making 4,000 taps a minute has been introduced by the Solvo Laboratories, Inc., Milford, Conn., to loosen the scale and other foreign matter which lodges in a radiator core. It is used in conjunction with the flushing operation in cleaning radiators.

Cumulative New Commercial Car Registration Statistics, August, 1930

Comparative figures for August, 1929, appear on Page 7.

Returns for today: Connecticut, Idaho, Maryland, Montana, New Hampshire, North Carolina, Ohio, Oregon, Rhode Island, Virginia, Washington

Some of this data has been published previously, but it is given here complete for the convenience of our subscribers.

Figures in this table are from R. L. Polk & Co. of Detroit, with the exception of Illinois, which are supplied by the Robinson Advertising Service, Springfield, Ill., and New Jersey, which are furnished by the New Jersey Motor List Co., New Car Division, Trenton, N. J. Readers desiring county, city or town lists, or lists of owners in any given section, may obtain these by addressing any of these three companies. Commercial Car Registrations do not include buses.

States	Autocar	Brockway-Indiana	Chevrolet	Diamond-T	Dodge	Essex	Fargo	Federal	Ford	G. M. C.	International	Mack	Paige	Relay	Reo	Republic	Rugby	Sterling	Stewart	Studebaker	Whippet	White	Willys	Willys-Knight	Miscellaneous	Totals	States
Arkansas			117		6		1		124	2	21				1						1	1	3		4	281	Arkansas
Conn.	3	7	120	8	13	1	3	7	218	18	17	14		1	15			4	14	5		5	2		11	486	Conn.
Delaware	1	1	22		2				50	1	1				1				2			2			2	85	Delaware
Florida			109						202																	311	Florida
Idaho			121		3		3		183	6	27	2			2			1		1			3			352	Idaho
Illinois	5	3	360	22	26	1		7	587	12	120	10	1	1	14	3		4	1		3	10	2	3	105	1300	Illinois
Maryland	4	5	103	3	7		3	3	221	9	30	11			10	4	1		3	1		21	4		16	459	Maryland
Minn.		2	284	15	19		3	4	501	6	93	2	2	1	15	2	2			2	3	2	21	4	2	985	Minn.
Missouri	6	3	340	16	20	2		3	598	20	84	9	2		6	2		1	2	3	5	8	7	1	26	1164	Missouri
Montana			97		8		6	1	198	2	83	1			7					1	1	6	4	1	3	419	Montana
N. Hamp.		1	42	5			3	1	104	2	7	3	1		6					1		2				178	N. Hamp.
N. Carolina			217		9	1	1		252	3	15	3			3						3				7	514	N. Car.
N. Dakota			71		3		2		72	2	36												1			187	N. Dakota
Ohio	4	9	411	2	36		6	12	771	37	101	6		4	12	2	6	1	11	2	5	39	15	9	40	1541	Ohio
Oregon	2		84		6		1	1	184	8	18	2			3		2	3		3		4	2		12	335	Oregon
Rh. Island	1	1	40	2	10		4	1	109	6	7	1			6	2	1	1	2		1	5			1	201	Rho. Isl.
S. Carolina		10	96					7	156	8	3	4										3			9	296	S. Car.
S. Dakota			139	7	7				146	1	94				5		1						4	2	2	408	S. Dak.
Utah			25		2				67	4	4	1			2		1								1	107	Utah
Virginia	3	4	216		7	1		1	243	8	16	12		1	5	3					3	6	1		4	534	Virginia
Wash'ton			149		5		1	3	427	17	42	8			10		2	1		2	1	8	5		21	702	Wash'ton
W. Virginia		3	113		14		2	1	149	8	14		1	1	6	2					3	2	2		5	326	West Va.
Wisconsin		1	252	19	15			2	393	16	71	2		1	14		2	4		1	2	3	10		5	813	Wisconsin
Dist. of Col.	2		27	2	6				98	4	4	2			1		1	2		1		5			1	156	D. of C.
Totals	31	50	3555	101	224	6	39	54	6053	200	908	93	7	10	144	20	19	22	35	23	31	132	86	20	277	12140	Totals

Equipment - - - Development

Scaling of Steel at Forging Temperatures

(Continued from Page 4)

accurately than the usual Orsat equipment.

The measurement of temperature was by means of a platinum, platinum - rhodium thermocouple with a suitable refractory protection tube, and a potentiometer. The temperature readings were made every minute during the time of testing and variations from the average temperature were within plus or minus 5 degrees Fahrenheit. The period of time the sample was in the furnace was counted by means of a stop watch from the instant the sample was placed in the furnace until it was removed. The rate of flow of gas was measured by means of a mercury flow gage calibrated against a wet test meter.

The steel sample was prepared in every case by polishing it with No. 00 emery cloth till the surface was perfectly bright. Care was exercised not to touch the sample with the hands once the surface was clean and bright. Samples were kept in a desiccator until they were mounted on the wire boat previous to placing in the furnace.

Results of Tests

In the case of the air, carbon dioxide and steam tests were made to determine (a) the rate of flow of the gas on scaling of steel at 2,300 degrees Fahrenheit, (b) the effect of the variation of temperature from 2,000 to 2,500 degrees Fahrenheit, (c) the effect of variation of time of exposure of the steel at 2,300 degrees Fahrenheit.

The steel used consisted of a bar two inches long and 13-16 inch round, weighing approximately 130 grams, cut from bars of steel of the following composition: Carbon, 0.13 to 0.15 per cent.; manganese, 0.49 per cent.; sulphur, 0.029 per cent.; phosphorus, 0.018 per cent.; silicon, 0.14 per cent.

Having determined the effect of moisture in the air on the scaling of steel, it was necessary to make all of the subsequent tests with dry air. The next series of tests made were for the purpose of determining the effect of the rate of flow of air on scaling at 2,300 degrees Fahrenheit. The rates of flow were increased in small increments from nearly 0 to 70 feet per minute. From 70 feet per minute the rate was increased to 120, then to 240, then to 385, and finally to 962 feet per minute. The duration of the tests in all cases was forty minutes. All rates of flow are calculated on the basis of the tube cross-section so that, when flowing past the sample, the velocity will be increased about 20 per cent., due to the space taken up by the sample.

The results of these tests show the surprising fact that with rates of flow higher than two feet per minute, that is to 962 feet per minute, the same scaling loss is produced. Rates of flow higher than 962 feet per minute have not been tested. Decreasing the rate of flow to four feet per minute causes no change in the amount of scale produced, and at two feet per minute the loss drops off slightly. At 0 rate of flow the scaling loss is less than 1-3 of that at two feet per minute. It is, of course, quite probable that at what is called 0 rate of flow there was some movement of the gas, since it will be evident that it was impossible to prevent some movement of the gas in a two-inch tube of the length used in these tests. By 0 rate of flow is merely meant that both ends of the tube were sealed during the entire period of the test.

This information serves as an independent check on the results of loss in weight provided of course that the average composition of the scale remains constant. The ratio of the loss in weight per 100 square inches to the weight of the scale per 100 square inches gives the average iron content of the scale. It will be observed that this ratio varies somewhat. This variation has been found to be greater when air or oxygen is the scaling medium than when carbon dioxide or steam is the scaling medium. The reason for this difference is not known. In plotting the results the loss in weight per 100 square inches is used in all cases rather than the weight of the scale.

The results are shown graphically in Figs. 2 and 3, Fig. 3 showing that portion of the curves under fifteen feet per minute presented in Fig. 2. So far as is known, this effect of rate of flow has never been reported and is, of course, of very considerable importance. We believe it explains some of the wide variations in scaling results which have been reported in the literature.

A series of tests was next made to determine the effect of variation in temperature on scaling. A uniform rate of flow of 60 feet per minute was used and each test was run 40 minutes. The effect of scaling was investigated at the temperatures of 2000, 2100, 2200, 2300, 2400 and 2475 degrees Fahrenheit. Although it was expected that there would be an increase in the amount of scale produced with an increase in temperature, it was scarcely thought that such large differences would be found with relatively small changes in temperature. The results have been plotted and are displayed in Fig. 4. This curve shows regular increase in scaling with increase in temperature, in fact between 2000 and 2300 degrees Fahrenheit the curve is a straight line. There is a tendency to a greater increase in scaling with temperatures above 2300 degrees Fahrenheit, and especially above 2400 degrees Fahrenheit. In the tests made at temperatures of 2400 degrees Fahrenheit and above, the steel sample becomes hotter than the furnace atmosphere, due to the exothermic reaction $3Fe + 2O_2 \Longrightarrow Fe_3O_4 + 270800$ calories. At these temperatures the rate of oxidation is rapid enough to increase the temperature in the heating chamber.

The results obtained with air at these temperatures, that is at 2400 degrees Fahrenheit and above, do not represent the amount of scale formed at the temperature since the steel becomes hotter than the furnace temperature. The results presented, therefore, merely represent the amount of scale formed when clean steel is placed in a furnace at these temperatures. In the case of test No. 551, although the sample was placed in the furnace at 2475 degrees Fahrenheit, the sample became so hot as to heat the surrounding atmosphere to 2540 degrees Fahrenheit. This same phenomenon was observed in the previous work of one of the authors in connection with a study of the burning of steel.

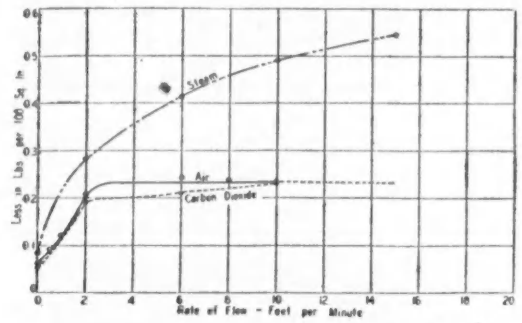


Fig. 3—Curves Showing Effect of Variation of Rate of Flow of Oxidizing Gases on Scaling of Steel.

For the tests made above 2400 degrees Fahrenheit a special refractory boat was used to support the sample. This boat was made from chrompatch cement the shape of a segment of a cylinder about one inch longer than the steel sample, about 1½ inches wide and about ¼ inch thick to fit into the muffle tube. Two cross bars consisting of small segments of thermocouple insulator tubes were cemented on to the boat and the steel sample placed across these bars. By this means the tube was protected from iron oxide that might drip off the steel sample and the steel sample only touched the refractory in two spots. Since there was some fusion of the oxide and consequent dripping off of the sample, no attempt was made to determine the quantity of scale formed and the loss in weight was the only determination made.

To study the effect of variations in time of exposure on scaling, tests were made at 2300 degrees Fahrenheit, in which the steel was exposed to the action of dry air for 5, 10, 15, 20, 40, 80, and 160 minutes. The rate of flow in all these tests was kept constant at 60 feet per minute. It must be borne in mind that the periods of exposure were for the total time in the furnace and not for the total time the sample was at heat. For instance, the samples heated for five minutes had barely reached 2300 degrees Fahrenheit when they were removed and quenched and consequently the amount of scale formed will represent what is formed while the sample is coming to heat. Greater time of exposure produced larger quantities of scale. However, as the time of exposure is increased, the rate of scaling is progressively slower. This is shown graphically in Fig. 5. The equation of this curve has been found to be $W^2 = 0.001254t$ where W is the loss in weight in pounds per 100 square inches and t is the time of exposure in minutes. This equation will not hold so well for the points below ten minutes for the reason just explained.

Oxygen

Only one series of tests has been made with oxygen. This series was made to study the effect of variation of temperature from 2000 to 2375 degrees Fahr. The oxygen used was the commercial tank oxygen which was found by analysis to contain 99.5 per cent. oxygen. It will be observed from Fig. 4 that the loss in weight from scaling increases very rapidly with increasing temperature. It will be noted that at 2375 degrees Fahr. all the steel is converted to oxide, whereas at 2300 degrees Fahr. only 11.17 per cent. of the iron is converted to oxide. This very decided increase in the rate of scaling appears to be due to the higher temperature to which the steel becomes heated by reason of rapid reaction with oxygen. After

(Continued on Page 11)

WISCONSIN AXLES . . . alone they may never close a sale. But they certainly make selling easier—with their reputation for dependable service.

WISCONSIN AXLE CO.
Oshkosh Wisconsin

Cumulative New Commercial Car Registration Statistics, August, 1929

This table is repeated for comparative purposes only. August, 1930, statistics appear on Page 6.

States	Autocar	Brockway-Indiana	Chevrolet	Diamond-T	Dodge	Essex	Fargo	Federal	Ford	G. M. C.	International	Mack	Paige	Relay	Reo	Republic	Rugby	Sterling	Stewart	Studebaker	Whippet	White	Willys	Willys-Knight	Miscellaneous	Totals	States
Ark., 1929			560		20	1	1	1	480	5	68	1			4				1		11	6			5	1164	Ark., 1929
Conn., 1929	9	17	151	11	58	2	5	7	213	25	28	33		1	59	1	5	1	8	4	3	8		1	19	669	Conn., '29
Del., 1929			39	1	1				65	4	5	1			2		1		1		2					122	Del., 1929
Fla., 1929		6	165		14				321	16	10	1			7					2	2	8				552	Fla., 1929
Idaho, '29			215		22		2		237	12	43				8		11			1	5	3		1	4	564	Idaho, '29
Ill., 1929	6	9	718	62	92		15	6	1073	46	140	16			33	1		9	2		40	19			106	2393	Ill., 1929
Md., 1929	20	13	184	9	39	4	6	4	296	31	42	17			20	2	2	2	10	3	4	16			16	740	Md., 1929
Minn., '29			421	2	38	1	12	7	555	22	123	9			27		1			1	28	9		4	23	1283	Minn., '29
Mo., 1929	6	5	527	23	62		6	8	817	39	97	14		1	20	4	5	6	1	7	41	6			13	1708	Mo., 1929
Mont., 1929			222		28		14	8	299	9	91	4			16		3			1	11	3		1	1	711	Mont., '29
N. H., 1929	2	2	52		11	2		3	84	6		1			6			1					1	1	172	N. H., '29
N. C., 1929		1	312		30		1	1	304	5	22	15			6	1					6	4			4	712	N. C., '29
N. D., 1929			142	1	8		3		182	11	77				2					3	8			1		438	N. D., '29
Ohio, '29	25	27	667	7	102	7	21	11	1102	79	139	29		5	57	1	6	1	6	2	66	66		15	57	2498	Ohio, '29
Ore., 1929			186		29		3	8	274	12	20	16			20	3	8	6			5	15			10	615	Ore., '29
R. I., 1929	1	2	61		23		4		86	18	3	5			14		4	4	1	1	2	4			5	238	R. I., '29
S. Car., '29			193		7		1	1	220	10	7	1				2			1		3	2				448	S. C., 1929
S. D., 1929		1	317		10				218		124			18		1		1	1	23					5	719	S. D., 1929
Utah, 1929			68		11		2		155	2	3				5		5				4				1	256	Utah, '29
Va., 1929	2	6	323	1	15			5	368	10	39	5		1	12	9	1		4	6	7	12			3	829	Va., 1929
Wash., '29			252		40		4	2	422	20	51	4		3	20		11	4		1	20	17			31	902	Wash., '29
W. Va., '29		9	200	5	25		2	6	232	16	36			2	9	3				2	11	1			1	560	W. Va., '29
Wis., 1929		1	342	15	52		9	3	503	20	69	3		4	42		1	13	5	5	22	2			17	1128	Wis., '29
D. of C., '29	3	3	24		2			1	83	13	6	2			2				2		2	5			8	156	D. C., '29
Totals	74	102	6341	137	739	17	111	82	8589	431	1243	177	*	35	391	28	64	48	43	62	303	206	*	24	330	19577	Totals

*Not on the market at that time.

MAJOR SPECIFICATIONS AND MECHANICAL DETAILS OF

Make and Model	Capacity—Tons	Chassis Price	Engine	No. of Cyl.	Bore and Stroke	Tax H. P.	Oil System	Carburetor	Fuel Feed	Ignit. System	Gear Set	Location	No. Spds. For.	Rear Axle	Final Drive	Reduction in Low	Brakes, Foot	Brakes, Hand	Standard Wheel Base	Chassis Weight	Standard Tire Sizes Rear	Front
Am. La France Chief	2	3650	Own	6	3¾x5	33.0	Pw	Str	Vac	DR	Own	C	4	Tim	Wo	31.2	4	D	156	6200	32x6	32x6D
Am. La France W	3-4	3950	Own 2 R	4	4½x6	28.9	CS	Zen	Vac	AB	Own	C	4	Own	2R	47.4	4	R	160	7200	S36x5	S36x5D
Am. La Fran. Chieftain	3-4	5500	Own	6	4⅛x5⅛	40.8	Pw	Zen	Vac	DR	Own	C	4	Tim	Wo	28.8	4	D	175	7200	S36x8	36x8D
Am. La France V	5	5500	Own 5 R	4	4¾x6	36.2	CS	Zen	Vac	AB	Own	C	4	Own	Wo	54.4	4	R	165	9800	S36x5	S40x6D
Am. La Fran. Big Chief	6	6725	Own	6	4½x6	48.6	Pw	Zen	Vac	DR	Own	C	4	Own	2R	32.8	4W	D	226	10600	S40x8	S40x8D
Am. La France U	7½	6000	Own 5 R	4	4¾x6	36.2	CS	Zen	Vac	AB	Own	C	4	Own	—	63.5	4	R	165	10500	S36x7	S40x8D
Austin	—	*	Own	4	2.2x3	7.8	CS	Til	—	Aut-L	W-G	U	3	Sal	Sp	—	4	4	75	——	3.75x18	3.75x18
Autocar A	1½-2	3200	Own	6	4 x4¾	38.4	Pw	Str	Vac	DR	Br-L 51	U	4	Own SA	Sp	27.9	4	R	150	5060	34x7	34x7
Autocar D	2-2½	3500	Own	6	4 x4¾	38.4	Pw	Str	Vac	DR	Br-L 51	U	4	Own SD	2R	33.7	4	R	150	5300	34x7	34x7D
*Autocar SH	2½-3	4300	Own	6	4¼x4¾	43.4	Pw	Str	Gra	LN	Own T	U	4	Own H	2R	44.3	R	R	114	6770	34x7	34x7D
Autocar SCH	2½-3	4300	Own	6	4¼x4¾	43.4	Pw	Str	Vac	LN	Own T	U	4	Own H	2R	44.3	R	D	157	6860	34x7	34x7D
*Autocar H	3	4100	Own	4	4½x5½	32.4	CS	Str	Gra	AB	Own T	U	4	Own H	2R	48.6	R	R	114	6770	34x7	34x7D
*Autocar HS	3½	4600	Own	4	4½x5½	32.4	CS	Str	Gra	AB	Own T	U	4	Own C	2R	53.6	R	R	114	7900	40x8	40x8D
*Autocar SHS	3-3½	4800	Own	6	4¼x4¾	43.4	Pw	Str	Gra	LN	Own T	U	4	Own C	2R	53.6	R	R	114	7900	40x8	40x8D
*Autocar SCHS	3-3½	4800	Own	6	4¼x4¾	43.4	Pw	Str	Vac	LN	Own T	U	4	Own C	2R	53.6	R	D	157	8180	40x8	40x8D
Autocar TEA	3-3½	5350	Own	6	4¼x4¾	43.4	Pw	Str	Vac	LN	Own T	U	12	Own TE	2R	101.7	4	D	192	8900	36x8	36x8D
Autocar TFA	3½-5	6100	Own	6	4½x4¾	48.6	Pw	Str	Vac	LN	Own T	U	12	Own TF	2R	101.3	4	D	192	9300	36x9	36x9D
Autocar C	3½-5	5500	Own	6	4½x4¾	48.6	Pw	Str	Vac	LN	Own B	C	4	Own C	2R	61.7	R	D	172	9500	42x9	42x9D
Autocar F	7½	6800	Own	6	4½x4¾	48.6	Pw	Str	Vac	LN	Br-L 70	C	7	Tim	Wo	94.0	4	D	173	11600	36x7S	40x8DS
Autocar G	10	9000	Own	6	4½x4¾	48.6	Pw	Str	Vac	LN	Br-L 70	C	7	Tim	Wo	97.7	WB	D	171	13000	36x8	36x8D
Brockway 85	1	1195	Con	6	3⅜x4⅝	27.3	Pw	Zen	Vac	Aut	Br-L	U	3	Col	Sp	21.3	4	Tr	137	3400	30x5	30x5
Brockway 75	¼	1290	Con	6	3⅜x4⅝	27.3	Pw	Zen	Vac	Aut	Br-L	U	4	Col	Sp	25.6	4	Tr	137	3450	32x6	32x6
Brockway 90	1½	1525	Con	6	3⅜x4⅝	27.3	Pw	Zen	Vac	Aut	Br-L	U	4	Col	Sp	25.6	4	Tr	149	3650	32x6	32x6
Brockway 120	2	1990	Con	6	4 x4⅛	38.4	Pb	Zen	P	Aut	Br-L	U	4	Tim	Sp	—	4	Tr	156	5290	32x6	32x6B
Brockway 140	2	2405	Con	6	4 x4⅛	38.4	Pb	Zen	P	Aut	Br-L	U	4	Wis	2R	—	4HV	D	166	5500	32x6	32x6D
Brockway 170	2½	3160	Con	6	4⅛x4¾	40.8	Pb	Zen	P	Aut	Br-L	U	4	Wis	2R	—	4HV	D	170	6800	32x6	32x6D
Brockway 195	3	3820	Con	6	4⅛x4¾	40.8	Pb	Zen	P	Aut	Br-L	U	4	Wis	2R	—	4HV	D	170	7500	34x7	34x7D
Brockway 190	3	4185	Con	6	4⅛x4¾	40.8	Pb	Str	P	Aut	Br-L	C	7	Tim	Wo	—	RV	D	168½	7625	34x7	34x7D
Brockway 220	3½	4560	Con	6	4⅜x4¾	45.9	Pb	Zen	P	Aut	Br-L	U	4	Wis	2R	—	4HV	D	170	8200	36x8	36x8D
Brockway 250	5	5950	Con	6	4⅜x4¾	45.9	Pb	Str	P	Aut	Br-L	U	4	Tim	Wo	—	4HV	D	182	10000	40x8	40x8D
Brockway 290	7½	7250	Con	6	4¾x5¾	54.15	Pw	Str	P	L-N	Br-L	C	7	Tim	Wo	—	4W	D	182	10750	38x7	40x14S
Brockway 640	10	9700	Con	6	4¾x5¾	54.15	Pw	Str	P	L-N	Br-L	C	7	Tim	Wo	—	4W	R	213	14000	38x7	36x10S
Chevrolet	½	365	Own	6	2⅞x3¾	26.3	CS	Car	P	DR	Own	U	3	Own	Sp	13.61	4	R	107	1835	4.75x19	4.75x19
Chevrolet	1½	520	Own	6	3⅛x3¾	26.3	CS	Car	P	DR	Own	U	4	Own	Sp	33.46	4	R	131	2375	30x5	30x5
Commerce Series S 11	2	2030	Bud H S 6	6	3⅜x4½	27.3	Pb	Zen	Vac	Aut	Br-L 20	U	4	Tim 54006	Sp	29.2	4		162	4500	32x6P	32x6D
Commerce Series 40	2	3240	Bud D S 6	6	3⅝x5	31.5	Pb	Zen	Vac	Aut	Br-L 35	U	4	Tim 63702	Wo	34.8	4		168	4900	36x6	36x6D
Commerce Series 40	2½	3240	Bud D S 6	6	3⅝x5	31.5	Pb	Zen	Vac	Aut	Br-L 35	U	4	Tim 63702	Wo	34.8	4		168	5100	36x6P	36x6D
Commerce Series 60	2½	4580	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Ful	U	5	Tim 65706DH	Wo	63.0	4		175	7000	36x6P	36x6D
Commerce Series 60	3	4680	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Ful	U	5	Tim 65706DH	Wo	63.0	4		175	7100	36x6P	36x6D
Commerce Series 80	3½	5250	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	C	7	Tim 66700DP	Wo	98.2	B		175	8200	36x6S	36x12S
Commerce Series 80	4	5330	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	C	7	Tim 66700DP	Wo	98.2	B		175	8400	36x6S	36x12S
Commerce Series 100	5	5830	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	C	7	Tim 68700DP	Wo	95.0	B		175	9600	36x6S	40x14S
Day Elder 60	1	1195	Con 25 A	6	3⅜x4	27.3	Pw	Zen	P	DR	W-G	U	4	Tim	Sp	36.3	4	R	135	3200	20x6.00B	20x6.50B
Day Elder 85	1½	1645	Con 16 C	6	3⅜x4⅝	27.3	Pw	Zen	P	DR	W-G	U	4	Tim	Sp	42.3	4	R	135	3750	20x6.00	20x6.50DB
Day Elder 110	2	2095	Con 16 C	6	3⅜x4⅝	27.3	Pw	Zen	P	DR	Br-L	U	4	Tim	Sp	44.9	4	D	156	4600	20x7.00	20x7.00DB
Day Elder 130	2½	2895	Con 16 R	6	4 x4⅛	38.4	Pw	Zen	P	DR	Br-L	U	4	Tim	Sp	40.7	4	D	150	6300	20x7.50B	20x7.50DB
Day Elder 160	3	3695	Con 18 R	6	4 x4½	38.4	Pw	Zen	P	DR	Br-L	U	4	Tim	Wo	36.1	4	D	156	6600	20x7.50B	20x9.00DB
Day Elder 200	4	4295	Con 18 R	6	4 x4½	38.4	Pw	Zen	P	DR	Br-L	U	4	Tim	Wo	43.5	4	D	156	7400	20x9.00B	20x9.00B
Day Elder 240	5	5500	Con 21 R	6	4⅜x4¾	45.9	Pw	Zen	V	DR	Br-L	C	4	Tim	Wo	50.8	4	D	162	9300	38x9P	38x9DP
Day Elder 285	8	6000	Con 21 R	6	4⅜x4¾	45.9	Pw	Zen	V	DR	Br-L	C	7	Tim	Wo	71.2	6	D	164	12000	20x8.25B	20x8.25DB
Day Elder 345	10	7500	Con 21 R	6	4⅜x4¾	45.9	Pw	Zen	V	DR	Br-L	C	7	Tim	Wo	79.9	4	D	164	12500	20x9.00B	20x9.00DB
Day Elder 402	12	8500	Con 16 H	6	4⅜x5¾	54.2	Pw	Zen	P	DR	Br-L	C	7	Tim	Wo	84.6	4	D	164	14000	20x9.75B	20x9.75DB
Diamond T 200	1	785	Bud	4	3¾x4½	22.5	*Pw	Zen	P	Aut	W-G	U	4	Cla	Sp	—	4	D	128½	3050	30x5	30x5
Diamond T 215	1	885	Bud	6	3⅜x4	27.3	Pw	Zen	P	Aut	W-G	U	4	Cla	Sp	—	4	D	135¼	3150	30x5	30x5
Diamond T 290	1½	1475	Her WXA 2	6	3½x4½	29.4	Pb	Zen	Vac	Aut	Cov	U	4	Col	Sp	—	4	D	156¼	4160	30x5	30x5D
Diamond T 303	2	1745	Her WXB	6	3¾x4½	33.7	Pb	Zen	Vac	Aut	Cov	U	4	Tim	Sp	—	4	D	160¾	4850	32x6	32x6D
Diamond T 551	2½	2250	Her WXC	6	4 x4½	38.4	Pb	Zen	Vac	Aut	Cov	U	4	Tim	Sp	—	4	D	168	5600	32x6	32x6D
Diamond T 503	2½	2660	Her WXC	6	4 x4½	38.4	Pb	Zen	Vac	Aut	Cov	U	4	Tim	Wo	—	4	D	174	6200	34x7	34x7D
Diamond T 506	2½	2820	Her WXC	6	4 x4½	38.4	Pb	Zen	Vac	Aut	Cov	U	4	Wis	2R	—	4	D	172½	6300	34x7	34x7D
Diamond T 602	3	3440	Her YXC	6	4⅜x4¾	45.9	Pb	Zen	Gra	Aut	Cov	C	4	Tim	Wo	—	4	D	169½	7500	36x8	36x8D
Diamond T 606	3	3500	Her YXC	6	4⅜x4¾	45.9	Pb	Zen	Gra	Aut	Cov	U	4	Wis	2R	—	4	D	186	7500	36x8	36x8D
Diamond T 700	3½	3740	Her YXC	6	4⅜x4¾	45.9	Pb	Zen	Gra	Aut	Cov	C	4	Tim	Wo	—	R	D	162	8100	S36x5	S36x10
Diamond T 801	4	4140	Her YXC	6	4⅜x4¾	45.9	Pb	Zen	Gra	Aut	Br-L	C	7	Own	Wo	—	6WH	D	189½	8300	36x8	4 wh 36x8
Diamond T 1000	5	4420	Her YXC 2	6	4½x4¾	48.6	Pb	Zen	Gra	Aut	Br-L	C	4	Tim	Wo	—	R	D	170½	9700	S36x6	S40x12
Diamond T 1200	6	5600	Her YXC 2	6	4½x4¾	48.6	Pb	Zen	Gra	Aut	Br-L	C	7	Tim	Wo	—	4RW	D	180	11000	34x7	4 w h 34x7D
Diamond T 1600	8	6220	Her YXC 3	6	4⅝x4¾	51.3	Pb	Zen	Gra	Aut	Br-L	C	7	Tim	Wo	—	4RW	D	190	11700	36x8	4 wh 36x8D
Diamond T 1601	8	7500	Wak 6 R B	6	5 x5¾	60.0	Pb	Zen	Gra	Mag	Br-L	C	7	Tim	Wo	—	4RW	D	194	12500	36x8	4 wh 36x8D
Diamond T 2500	10-12	8000	Wak 6 R B	6	5 x5¾	60	Pb	Zen	Gra	Mag	Br-L	C	7	Tim	Wo	—	4RW	D	194	13100	S36x7	4 wh 36x12S
Dodge Bros. UF10A	½	435	Own	4	3⅝x4¾	21.2	Pb	Car	P	DR	Own	U	3	Own	Sp	14.28	4	D	109	1855	5.00x19	5.00x19
Dodge Bros. F 10 A	½	515	Own	6	3¼x4⅛	23.4	Pb	Car	P	DR	Own	U	3	Own	Sp	14.28	4	D	109	1960	5.25x19	5.25x19
Dodge Bros. U-1	¾	695	Own	4	3⅝x4¼	21.3	Pb	Car	Vac	NE	Own	U	3	Own	Sp	21.68	4	D	124	2260	5.50x20B	5.50x20B
Dodge Bros DA1	¾	795	Own	6	3⅜x3⅞	27.3	Pb	Zen	Vac	NE	Own	U	4	Own	Sp	36.83	4	D	140	2955	30x5	30x5
Dodge Bros. UF30A	1½	595	Own	4	3⅝x4¾	21.0	Pb	Car	P	DR	Own	U	4	Own	Sp	37.17	4	D	136	2665	6.00x20	32x6
Dodge Bros. F 30 A	1½	695	Own	6	3⅛x4⅛	23.4	Pb	Car	P	DR	Own	U	4	Own	Sp	37.17	4	D	136	2765	6.00x20	32x6
Dodge Bros. F 35 A	1½	1425	Own	6	3⅜x3⅞	27.3	Pb	Zen	P	DR	Own	U	4	Own	Sp	41.43	4	D	140	3780	6.00x20	6.00x20D
Dodge Bros. F 40 A	2	1995	Own	6	3⅝x5	31.5	Pb	Zen	P	DR	Own	U	4	Own	Sp	43.73	4	D	150	5175	6.50x20	6.50x20D
Dodge Bros. F 60 A	3	2645	Own	6	3⅝x5	31.5	Pb	Zen	P	DR	Own	U	4	Own	Sp	48.87	4	D	146	5543	32x6	32x6D
Dodge Bros. F 61 A	3	2575	Own	6	3⅝x5	31.5	Pb	Zen	P	DR	Own	U	4	Own	Sp	48.87	4	D	170	5789	32x6	32x6D
Durant	¾	495	Con	4	3⅜x4¼	18.2	Pb	Til	Vac	Aut	Own	C	3	Own	Sp	16.16	4	4	107	1670	28x4.75	28x4.75
Essex Commercial	¾	445	Own	6	2¾x4½	18.2	CS	Mar	Vac	Aut	Own	U	3	Own	Sp	17.8	4	4	110	2150	30x5	31x5.50
Fargo Packet	½	545	Own	6	3 x4⅛	21.6	Pb	Str	Vac	NE	Own	U	3	Own	Sp	14.29	4	Tr	——	1835	5.00x19	5.00x19
Fargo Clipper	¾	725	Own	6	3⅛x4¼	23.4	Pb	Str	Vac	DR	Own	U	3	Own	Sp	15.53	4	Tr	——	2325	5.50x18	5.50x18
Fargo Freighter	1	795	Own	6	3 x4⅛	21.6	Pb	Str	Vac	NE	Own	U	4	Own	Sp	37.19	4	Tr	——	2785	6.00x20	32x6
Federal D	1-1½	830	Con W 10	4	3⅞x4¼	24.0	Pb	Zen	P	DR	W-G T9	U	4	Cla B374	Sp	40.8	4	Tr	131	3185	6.00x20	32x6
Federal E6	1-1½	1090	Con 17 C	6	3⅜x4	27.3	Pb	Zen	Vac	DR	W-G T9	U	4	Cla B370	Sp	34.6	4	Tr	132	3260	6.00x20	32x6
Federal F7	1½	1525	Con 16 C	6	3⅜x4⅝	27.3	Pb	Zen	P	DR	Own	U	4	Tim 52005H	Sp	24.3	4	Tr	132	3765	30x5	30x5D
Federal A6	2	1855	Con 16 C	6	3⅜x4⅝	27.3	Pb	Zen	Vac	DR	Own	C	4	Cla B610	Sp	38.5	4	Tr	151	4580	32x6	32x6D
Federal A6T	2½	2185	Con 16 C	6	3⅜x4⅝	27.3	Pb	Zen	Vac	DR	Own	C	4	Tim 58000H	Sp	41.3	4	Tr	151	4950	32x6	32x6D
Federal A6TW	2½	2360	Con 16 C	6	3⅜x4⅝	27.3	Pb	Zen	Vac	DR	Own	C	4	Tim 65001H	Wo	42.0	4	Tr	151	4950	32x6	32x6D
*Federal DSW	2½-3	1050	Con W 10	4	3⅞x4¼	24.0	Pb	Zen	P	DR	W-G T9	U	4	Cla B-374	Sp	40.8	6	Tr	158	3800	6.00x20	32x6
Federal T10B	2½-3	2740	Con 16 R	6	4 x4⅛	38.4	Pb	Zen	P	DR	Own	C	4	Tim 58200H	Sp	36.3	4	Tr	165	6550	34x7	34x7D
Federal T10W	2½-3	2915	Con 16 R	6	4 x4⅛	38.4	Pb	Zen	P	DR	Own	C	4	Tim 65201H	Wo	44.0	4	Tr	165	6550	34x7	34x7D
Federal U6	3-3½	3860	Con 18 R	6	4 x4½	38.4	Pb	Str	P	DR	Br-L 55	C	7	Tim 65706HP	Wo	64.6	4	D	165	7220	34x7	34x7D
Federal 4C6A	4-5	4735	Con 20 R	6	4⅛x4¾	40.8	Pb	Zen	P	DR	Br-L 55	C	7	Tim 66704HP	Wo	73.6	4	D	192	8330	36x8	36x8D
Federal 4C6AB	4-5	4960	Con 20 R	6	4⅛x4¾	40.8	Pb	Zen	P	DR	Br-L 55	C	7	Tim 66704TWP	Wo	73.6	4	D	192	8850	36x8	36x8D
*Federal U6SW	6	6000	Con 20 R	6	4⅛x4¾	40.8	Pb	Zen	P	DR	Br-L 55	C	7	Tim SW 200	Wo	71.3	6	Tr	201	9850	34x7	34x7D
*Federal U6SWAB	6	6500	Con 20 R	6	4⅛x4¾	40.8	Pb	Zen	P	DR	Br-L 55	C	7	Tim SW 200	Wo	71.3	6	Tr	201	9900	34x7	34x7D
Federal X8	7½	5085	Con B 7	4	5 x6	40	Pw	Zen	Vac	AB	Br-L 60	C	7	Tim 68700DP	Wo	110.9	R	D	162	9750	36x6S	40x14S
Federal X8R	7½	5810	Con 21 R	6	4⅜x4¾	45.9	Pb	Zen	P	DR	Br-L 60	C	7	Tim 68700DP	Wo	110.9	R	D	162	10000	40x8	40x8D
*Federal 4C6SW	8	7500	Con 21 R	6	4⅜x4¾	45.9	Pb	Zen	P	DR	Br-L 55	C	7	Tim SW 300	Wo	80.8	6	Tr	231	11500	36x8	36x8D
Ford AA	1½	510	Own	4	3⅞x4¼	24.0	Sp	Zen	Gra	Own	Own	U	4	Own	St	42.24	4	R	131½	2723	6.00x20	32x6
Ford AA	1½	535	Own	4	3⅞x4¼	24.0	Sp	Zen	Gra	Own	Own	U	4	Own	St	42.24	4	R	157	3161	6.00x20	6.00x20
F. W. D.—H	1½	3300	Wis S U	4	4 x5	25.6	Pb	Zen	Vac	Eis	Cotta	C	4	Own	St	38.1	4	R	121	5300	34x7	34x7
F. W. D.—H6	2	3425	Wak	6	3¾x4½	29.4	Pb	Zen	Vac	Eis	Br-L	U	4	Own	St	35.0	4	R	133	5500	34x7	34x7
F. W. D.—BTL4	2	3900	Wis S U	4	4 x5	25.6	Pb	Zen	Vac	Eis	Br-L	C	7	Own	St	84.7	4	R	120	6000	36x8	36x8
F. W. D.—HH6	2½	4000	Wak	6	3¾x4½	33.7	Pb	Zen	Vac	Eis	Br-L	C	7	Own	St	101.0	4	R	133	5700	36x8	36x8
F. W. D.—B	3	4200	Own	4	4¾x5½	36.1	Pb	Str	Gra	Eis	Own	C	3	Own	St	35.6	4	R	124	6460	36x6S	36x6S
F. W. D.—B 5	3	4525	Own	4	4¾x5½	36.1	Pb	Str	Gra	Eis	Own	C	5	Own	St	88.6	4	R	132	6800	36x6S	36x6S
F. W. D.—B T	3	4742	Own	4	4¾x5½	36.1	Pb	Str	Vac	Eis	Own	C	5	Own	St	101.0	4	R	133¾	7700	40x7S	40x5SD
F. W. D.—U 4	3	4575	Own	4	4¾x5½	36.1	Pb	Str	Vac	Eis	Own	C	5	Own	St	88.6	4	R	148	7000	36x6S	36x6S

1930 COMMERCIAL CARS BUILT IN THE UNITED STATES

Make and Model	Capacity—Tons	Chassis Price	Engine	No. of Cyl.	Bore Stroke	Tax H. P.	Oil System	Carburetor	Fuel Feed	Ignit. System	Gear Set	Location	No. Spds. For.	Rear Axle	Final Drive	Reduction in Low	Brakes, Foot	Brakes, Hand	Standard Wheel Base	Chassis Weight	Standard Tire Sizes Front	Rear
F. W. D.—C U 6	3½	5120	Wak	6	4 x4¾	38.6	Pb	Zen	Vac	Eis	Own	C	5	Own	St	88.6	4	R	148	7200	36x6S	36x8S
*F. W. D.—X 6	6	6500	Wak	6	4¼x4¾	43.3	Pb	Zen	Vac	Eis	Own	C	5	Own	St	88.6	"	4	170	9500	36x8	36x8
Garford Series S 11	2	2030	Bud H S 6	6	3⅜x4½	27.3	Pb	Zen	Vac	Aut	Br-L	U	4	Tim	Sp	29.2	4	D	162	4500	32x6	D32x6
Garford Series 40	2	3240	Bud D S 6	6	3⅝x5	31.5	Pb	Zen	Vac	Aut	Br-L	U	4	Tim	Wo	34.8	4	D	168	4900	36x6	D36x6
Garford Series 40	2½	3240	Bud D S 6	6	3⅝x5	31.5	Pb	Zen	Vac	Aut	Br-L	U	4	Tim	Wo	34.8	4	D	168	5100	36x6	D36x6
Garford Series 60	2½	4580	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Ful	U	5	Tim	Wo	63.0	4	D	175	7000	36x6	D36x6
Garford Series 60	3	4680	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Ful	U	5	Tim	Wo	63.0	4	D	175	7100	36x6	D36x7
Garford Series 80	3½	5250	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	C	7	Tim	Wo	98.2	4	D	175	8200	S36x6	S36x12
Garford Series 80	4	5330	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	C	7	Tim	Wo	98.2	4	D	175	8400	S36x6	S36x14
Garford Series 100	5	5830	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	C	7	Tim	Wo	95.0	4	D	175	9600	S36x6	S40x14
Gen. Mot. T11-1001	*3800	625	Pontiac	6	3⅛x3⅞	26.3	Pb	Mar	P	DR	Own	U	3	Pontiac	Sp	14.7	4	4	109⅝	1980	5.00x19B	5.50x19B
Gen. Mot. T15-1501	*5400	695	Pontiac	6	3⅛x3⅞	26.3	Pb	Mar	P	DR	Own	U	3	Tim 51500	Sp	16.14	4	4	130	2625	5.50x20B	5.50x20B
Gen. Mot. T17-1701	*5500	735	Pontiac	6	3⅛x3⅞	26.3	Pb	Mar	P	DR	Own	U	3	Tim 51505	Sp	16.04	4	4	130	2650	6.50x20B	6.50x20B
Gen. Mot. T17-1707	*6500	750	Pontiac	6	3⅛x3⅞	26.3	Pb	Mar	P	DR	Own	U	3	Tim 51505	Sp	16.04	4	4	130	2670	5.50x20B	32x6
Gen. Mot. T19-2201	*6300	895	Pontiac	6	3⅛x3⅞	26.3	Pb	Mar	P	DR	Mun	U	4	Tim 5261	Sp	34.45	4	D	130	2850	5.50x20B	32x6
Gen. Mot. T19-2214	*8500	995	Pontiac	6	3⅛x3⅞	26.3	Pb	Mar	P	DR	Mun	U	4	Tim 5261	Sp	34.45	4	D	130	2925	30x5	30x5D
Gen. Mot. T25-2501	*6800	1235	Buick	6	3⅞x4⅝	28.3	Pb	Mar	P	DR	Mun	U	4	Tim 5261	Sp	29.62	4	D	130	3375	6.00x20B	7.50x20B
Gen. Mot. T25-2509	*8500	1300	Buick	6	3⅞x4⅝	28.3	Pb	Mar	P	DR	Mun	U	4	Tim 5261	Sp	29.62	4	D	130	3425	30x5	30x5D
Gen. Mot. T30-3206	*9000	1555	Buick	6	3⅞x4⅝	28.3	Pb	Mar	P	DR	Mun	U	4	Eat 1617	Sp	28.6	4	D	141	4450	6.00x20B	8.25x20B
Gen. Mot. T30-3203	*11000	1605	Buick	6	3⅞x4⅝	28.3	Pb	Mar	P	DR	Mun	U	4	Eat 1617	Sp	28.6	4	D	141	4525	32x6	32x6D
Gen. Mot. T42-4206	*10600	1735	Buick	6	3⅞x4⅝	28.3	Pb	Mar	P	DR	Mun	U	4	Eat 1717	Sp	33.38	4	D	141	4575	7.00x20B	9.00x20B
Gen. Mot. T42-4203	*14900	1960	Buick	6	3⅞x4⅝	28.3	Pb	Mar	P	DR	Mun	U	4	Eat 1717	Sp	33.38	4	D	141	4905	36x6	36x6D
Gen. Mot. T44-4401	*12000	1965	Buick	6	3⅞x4⅝	28.3	Pb	Mar	P	DR	Mun	U	4	Eat T44DR	2R	40.89	4	D	141	4825	32x6	32x6D
Gen. Mot. T44-4404	*15000	2095	Buick	6	3⅞x4⅝	28.3	Pb	Mar	P	DR	Mun	U	4	Eat T44DR	2R	40.89	4	D	141	5095	34x7	34x7D
Gen. Mot. T60-6202	*16500	3035	Buick	6	3¾x5	33.7	Pb	Mar	P	DR	Mun	U	4	Tim 65706	Wo	52.53	4	D	154¼	6925	34x7	34x7D
Gen. Mot. T60-6205	*18500	3150	Buick	6	3¾x5	33.7	Pb	Mar	P	DR	Mun	U	4	Tim 65706	Wo	52.53	4	D	154¼	6925	9.00x20B	9.00x20DB
Gen. Mot. T82-8202	*19000	3795	Buick	6	3¾x5	33.7	Pb	Mar	P	DR	Br-L	C	5	Tim 66704	Wo	82.2	4	D	155	7500	9.00x20B	9.00x20DB
Gen. Mot. T82-8207	*22000	4070	Buick	6	3¾x5	33.7	Pb	Mar	P	DR	Br-L	C	5	Tim 66704	Wo	82.2	4	D	155	7850	38x7	38x9D
Gen. Mot. T90-9001	*23000	5885	Buick	6	3¾x5	33.7	Pb	Mar	P	DR	Br-L	C	5	Tim SW-200	Wo	76.04	WR	D	185¼	9400	7.50x20B	7.50x20D
Gen. Mot. T90-9004	*28000	6055	Buick	6	3¾x5	33.7	Pb	Mar	P	DR	Br-L	C	5	Tim SW-200	Wo	76.04	WR	D	185¼	9775	8.25x20B	8.25x20DB
*Gramm B	1¾	1495	Lyc 4 SL	6	3¼x4½	25.3	Pb	Zen	Vac	Aut	Cov	U	4	Tim	Sp	34.3	4	Tr	140	3800	6.50x20	6.50x20D
*Gramm C	2	1795	Lyc ASA	6	3⅝x4½	31.54	Pb	Zen	P	Aut	Cov	U	4	Tim	Sp	31	4	Tr	160	4820	7.00x20	7.00x20D
*Gramm D	2½	2195	Lyc TS	6	3⅞x5	36	Pb	Zen	P	Aut	Cov	U	4	Tim	Sp	33	4	Tr	160	5100	7.50x20	7.50x20D
*Gramm E	3	2595	Lyc TS	6	3⅞x5	36	Pb	Zen	P	Aut	Ful	U	4	Tim	Sp	35	4	Tr	160	5300	8.25x20	8.25x20D
*Gramm EY	3	3595	Con 20 R	6	4⅛x4¾	40.80	Pb	Zen	P	Aut	Ful	U	4	Tim	Sp	30	4	D	190	6750	32x6	32x6D
*Gramm T-38	3	3595	Lyc TS	6	3⅞x5	36	Pb	Zen	P	Aut	Ful	U	4	Wis	2R	45	D	R	153	7200	36x5S	36x10S
*Gramm O-45	4	3995	Lyc TS	6	3⅞x5	36	Pb	Zen	P	Aut	Ful	C	8	Wis	2R	75.8	D	R	153	7700	36x5S	36x12S
*Gramm GY	4	4345	Con 21 R	6	4⅜x4¾	45.9	Pb	Zen	P	Aut	Ful	U	4	Wis	2R	28	4	D	210	7200	34x7	34x7D
*Gramm O-60	5	4745	Lyc TS	6	3⅞x5	36	Pb	Zen	P	Aut	Ful	C	8	Wis	2R	78.4	D	R	153	8800	36x6S	36x14S
*Gramm HY	5	6545	Con 16 H	6	4¾x5¾	54.15	Pb	Zen	P	Aut	Ful	U	4	Wis	2R	25.2	4	D	236	9600	36x8	36x8D
Indiana 64	1	1195	Con	6	3⅜x4⅝	27.3	Pb	Str	Vac	Aut	Br-L	U	3	Col	Sp	21.3	4	Tr	137	3435	30x5	30x5
Indiana 74	1¼	1290	Con	6	3⅜x4⅝	27.3	Pb	Str	Vac	Aut	Br-L	U	4	Col	Sp	25.6	4	Tr	137	3450	32x6	32x6
Indiana 11	1¼	1425	Her	4	4 x5	25.6	Pb	Str	Gra	Aut	Br-L	U	3	Cla	Sp	24.48	R	R	129½	3500	30x5	30x5
Indiana 89	1½	1525	Con	6	3⅜x4⅝	27.3	Pb	Str	Vac	Aut	Br-L	U	4	Col	Sp	25.6	4	Tr	149	3650	32x6	32x6
Indiana 111	1½	1630	Her	4	4 x5	25.6	Pb	Str	Gra	Aut	Br-L	U	3	Cla	Sp	26.4	R	R	129½	3600	30x5	32x6
Indiana 111 XW	2	1850	Her	4	4 x5	25.6	Pb	Str	Vac	Eis	Br-L	U	4	Wis	2R	30.14	R	Tr	120	3740	32x6	32x6D
Indiana 120	2	1990	Con	6	4 x4⅛	38.4	Pb	Str	P	Aut	Br-L	U	4	Tim	Sp	—	4	Tr	156	5200	32x6	32x6D
Indiana 140	2	2495	Con	6	4 x4⅛	38.4	Pb	Str	P	Aut	Br-L	U	4	Wis	2R	—	4V	Tr	156	5500	32x6	32x6D
Indiana 115 A	2½	2740	Her	4	4¼x5	28.9	Pb	Str	Vac	Eis	Br-L	U	4	Cla	Sp	42.99	R	Tr	132	4970	32x6	34x7D
Indiana 170	2½	3160	Con	6	4⅛x4¾	40.8	Pb	Str	P	Aut	Br-L	U	4	Wis	2R	—	4HV	D	170	6800	32x6	32x6D
Indiana 127 AW	3	3775	Her	4	4¼x5	28.90	Pb	Str	Vac	Eis	Br-L	U	5	Wis	2R	41.72	RV	D	158¼	7000	34x7	34x7D
Indiana 627 AW	3	4075	Wis	6	4 x5	38.40	Pb	Str	Vac	Eis	Br-L	U	5	Wis	2R	41.72	RV	D	156¼	7200	34x7	34x7D
Indiana 195	3	3820	Con	6	4⅛x4¾	40.8	Pb	Str	P	Aut	Br-L	U	4	Wis	2R	—	4HV	D	170	7500	34x7	34x7D
Indiana 190	3	4185	Con	6	4⅛x4¾	40.8	Pb	Str	P	Aut	Br-L	C	7	Tim	Wo	—	RV	D	168½	7625	34x7	34x7D
Indiana 220	3½	4560	Con	6	4⅜x4¾	45.9	Pb	Str	P	Aut	Br-L	U	4	Wis	2R	—	4HV	D	170	8200	36x8	36x8D
Indiana 250	5	5950	Con	6	4⅜x4¾	45.9	Pb	Str	P	Aut	Br-L	U	4	Tim	Wo	—	4HMV	D	182	10000	40x8	40x8D
Indiana 290	7	7250	Con	6	4¾x5¾	54.15	Pb	Str	P	L-N	Br-L	C	7	Tim	Wo	—	4W	D	182	10750	38x7	40x14S
Indiana 640	10	9700	Con	6	4¾x5¾	54.15	Pb	Str	P	L-N	Br-L	C	7	Tim	Wo	—	4RW	D	212	14000	38x7	36x10S
International AW-1	¾	720	Wak X A	4	3½x4½	19.6	Pb	Zen	Vac	DR	Mec	U	3	Eat 517	Sp	17.4	4	2	136	2620	5.25x20	5.25x20
Int. Harvester Sp. Del.	¾	720	Wak X A	4	3½x4½	19.6	Pb	Zen	Vac	DR	Mec	U	3	Eat 502 R	Sp	15.1	4	2	124	2200	30x5.25	30x5.25
Int. Harv. 6 Spd. Spec.	1	820	Wak X A	4	3½x4½	19.6	Pb	Zen	Vac	DR	Mec	U	3	Eat 1124	Sp	52.6	4	2	124	2430	30x5	30x5
Int. Harvester S-24	1¼	1160	Lyc C T	4	3¾x5	22.5	Pw	Zen	Vac	DR	Own	U	3	Eat 1002	Sp	21.3	4	2	130	3200	30x5	30x5
Int. Harvester S-26	1¼	1310	Lyc 4 S L	6	3¼x4½	25.3	Pb	Zen	Vac	DR	Own	U	3	Eat 1002	Sp	21.3	4	2	130	3250	30x5	30x5
Int. Harvester SF-34	1½	1450	Lyc C T	4	3¾x5	22.5	Pw	Zen	Vac	DR	Own	U	3	Eat 1502	Sp	22.6	4	2	140	3520	30x5	32x6
International AL-3	1½	1450	Lyc SLH	6	3¼x4½	25.3	Pb	Zen	Vac	DR	W-G	U	4	Eat 1518	Sp	42.9	4	2	138	4200	6.00x20	6.00x20D
Int. Harvester SF-36	1½	1600	Lyc 4 S L	6	3¼x4½	25.3	Pb	Zen	Vac	DR	Own	U	3	Eat 1502	Sp	22.6	4	2	140	3570	30x5	32x6
Int. Harvester SD-44	2	1590	Lyc C T	4	3¾x5	22.5	Pw	Zen	Vac	AB	Own	U	4	Eat 2002	Sp	40.6	4	2	117	3700	30x5	32x6
Int. Harvester SD-46	2	1740	Lyc 4 S L	6	3¼x4½	25.3	Pb	Zen	Vac	AB	Own	U	4	Eat 2002	Sp	40.6	4	2	117	3750	30x5	32x6
Int. Harvester SF-46	2	1950	Lyc 4 S L	6	3¼x4½	25.3	Pb	Zen	Vac	DR	Own	U	4	Eat 2002	Sp	40.6	4	2	140	4000	32x6	32x6D
Int. Harvester A-4	2	1985	Own-FBB	6	3⅝x4½	31.5	Pb	Zen	Vac	DR	Own	U	5	Eat 1712	Sp	47.8	4	2	145	5070	32x6	32x6D
Int. Harvester HS-54	2½	3850	Hall-S 151	4	4¼x5½	28.9	Pb	Zen	Vac	RB	Own	U	5	Eat 54	2R	60.5	4	4	148	8000	36x5S	36x8S
Int. Harvester HS-54-C	2½	3850	Hall-S 151	4	4¼x5½	28.9	Pb	Zen	Vac	RB	Own	U	5	Own A M 428	Ch	63.8	4	4	148	8665	36x5S	36x10S
Int. Harvester W-1	2½	3850	Hall-S 151	4	4¼x5½	28.9	Pb	Zen	Vac	RB	Own	U	5	Eat 58	2R	60.5	4	2	148	8300	36x5S	36x8S
Int. Harvester A-5	3	2550	Own-FBB	6	3⅝x4½	31.5	Pb	Zen	Vac	DR	Own	U	5	Eat 2112	Sp	52.6	4	2	156	5606	34x7	34x7D
Int. Harvester HS-74	3½	4850	Hall-S 152	4	4¾x5½	36.1	Pb	Zen	Vac	RB	Own	U	5	Eat 74	2R	70.5	4	4	160	10700	36x5S	40x12S
Int. Harvester HS-74-C	3½	4850	Hall-S 152	4	4¾x5½	36.1	Pb	Zen	Vac	RB	Own	U	5	Own A M 427	Ch	79.1	4	4	160	11000	36x6S	40x12S
Int. Harv's'r HS-104-C	5	5500	Hall-S 152	4	4¾x5½	36.1	Pb	Zen	Vac	RB	Own	U	5	Own A M 427	Ch	90.5	4	4	160	11095	36x6S	40x14S
La France-Repub. A-1	*6000	795	Lyc	6	2⅞x4¾	19.8	Pb	Zen	Vac	Aut	Ful	U	4	Tim	Sp	36.1	4	Tr	132	3000	5.50x20	32x6
La France-Repub. C-1	*7000	1295	Lyc	6	3¼x4½	25.4	Pb	Zen	Vac	Aut	Ful	U	4	Tim	Sp	29.1	4	Tr	144	3300	6.00x20	32x6
La France-Repub. D-1	*9000	1595	Lyc	6	3¼x4½	25.4	Pb	Zen	Vac	Aut	Ful	U	4	Tim	Sp	37.9	4	Tr	144	3725	30x5	30x5D
La France-Repub. F-2	*13000	2395	Lyc	6	3⅝x5	31.5	Pb	Zen	Vac	Aut	Ful	U	4	Tim	Sp	40.1	4	D	174	5400	32x6	32x6D
La France-Repub. H-1	*15000	2985	Lyc	6	3⅞x5	36.0	Pb	Zen	Vac	Aut	Ful	U	4	Eat	Sp	36.0	4	D	163	5850	34x7	34x7D
La France-Repub. L-1	*18000	3595	Lyc	6	3⅞x5	36.0	Pb	Zen	Vac	Aut	Ful	U	4	Eat	2R	48.0	4	D	180	6900	36x8	36x8D
La France-Repub. M-1	*20000	3800	Wak	6	4 x4¾	38.4	Pb	Zen	Vac	Aut	Ful	U	5	Eat	2R	62.3	R	D	171	6900	36x8	36x8D
Mack BL	1	2500	Own	6	3¼x5	25.39	Pw	Str	Vac	NE	Own	U	4	Own	Sp	Opt	4	D	148	—	B6.00x20	DB6.00x20
†Mack BG	1½	3000	Own	6	3⅝x5	31.57	Pw	Str	Vac	NE	Own	U	4	Own	Sp	Opt	4	D	138-156	—	32x6	D32x6
Mack AB	2½-3	3950	Own	4	4¼x5	28.9	Pb	Str	Gra	RB	Own	U	4	Own	2R	Opt	R	D	2-Opt	—	36x4S	36x8S
††Mack AB	2½-3	3500	Own	4	4¼x5	28.9	Pb	Str	Gra	RB	Own	U	4	Own	Ch	Opt	R	D	2-Opt	—	36x4S	36x8S
Mack AB	2½-3	4750	Own	6	3⅝x5	31.57	Pw	Str	Vac	NE	Own	U	4	Own	2R	Opt	R	D	2-Opt	—	34x7	D34x7
††Mack AB	2½-3	4300	Own	6	3⅝x5	31.57	Pw	Str	Vac	NE	Own	U	4	Own	Ch	Opt	R	D	2-Opt	—	34x7	D34x7
††Mack B	3-4	5250	Own	6	4 x5½	38.4	Pb	Str	Vac	NE	Own	U	4	Own	2R	Opt	4	D	2-Opt	—	36x8	D36x8
††Mack BC	3½-5	5500	Own	6	4 x5½	38.4	Pb	Str	Vac	NE	Own	U	4	Own	Ch	Opt	4	D	2-Opt		36x8	36x8D
††Mack BJ	3½-5	6150	Own	6	4½x5½	48.6	Pb	Str	Vac	NE	Own	C	4	Own	2R	Opt	4	D	3-Opt	—	36x8	36x8D
†Mack AK	3½-5	5150	Own	4	5 x6	40.0	Pb	Str	Gra	RB	Own	J	4	Own	Ch	Opt	4	J	3-Opt	—	36x5S	36x5DS
††Mack AK	3½-5	5250	Own	4	5 x6	40.0	Pb	Str	Gra	RB	Own	C	4	Own	2R	Opt	4	D	3-Opt	—	36x5S	36x5DS
††Mack AC	3½-5	4950	Own	4	5 x6	40.0	Pb	Str	Gra	RB	Own	J	4	Own	Ch	Opt	J	R	3-Opt	—	36x5S	40x10S
††Mack AC	5½-7	5500	Own	4	5 x6	40.0	Pb	Str	Gra	RB	Own	J	4	Own	Ch	Opt	J	R	3-Opt	—	36x6S	40x12S
††Mack AC	7½	6000	Own	4	5 x6	40.0	Pb	Str	Gra	RB	Own	J	4	Own	Ch	Opt	J	R	3-Opt	—	36x7S	40x14S
††Mack AP	7½	9500	Own	6	5 x6	60.0	Pb	Str	Gra	NE	Own	J	4	Own	Ch	Opt	R	J	191	—	36x7S	40x8DS
††Mack A C 6-wheel	10	7500	Own	4	5 x6	40.0	Pb	Str	Gra	RB	Own	J	4	Own	Ch	Opt	4R	J	3-Opt	—	36x7S	40x12S
††Mack AP 6-wheel	10	12000	Own	6	5 x6	60.0	Pb	Str	Gra	NE	Own	J	4	Own	Ch	Opt	4R	J	3-Opt	—	36x7	40x12S
Paige	¾	860	Own	6	3¼x4½	25.35	Pb	DL	P	DR	W-G	U	3	Sal	Sp	17.36	4	Tr	115	2465	B5.50x19	B5.50x19
Relay Series 40	2	3240	Bud D S 6	6	3⅝x5	31.5	Pb	Zen	Vac	Aut	Br-L	U	4	Own	R	34.5	4	D	168	5500	36x6	D36x6
Relay Series 50	2	3860	Bud D W 6	6	3¾x5	33.7	Pb	Zen	Vac	Aut	Br-L	U	5	Own	R	58.5	4	D	161	6800	36x6	D36x6
Relay Series 40	2½	3240	Bud D S 6	6	3⅝x5	31.5	Pb	Zen	Vac	Aut	Br-L	U	4	Own	R	34.5	4	D	168	5700	36x6	D36x6
Relay Series 50	2½	4000	Bud D W 6	6	3¾x5	33.7	Pb	Zen	Vac	Aut	Br-L	U	5	Own	R	58.5	4	D	161	7000	36x6	D38x7
Relay Series 60	2½	4555	Bud B A 6	6	4 x5⅛	40.8	Pb	Zen	Vac	Aut	Ful	U	5	Own	R	63.7	4	D	175	7350	36x6	D36x6
Relay Series 50	3	4130	Bud D W 6	6	3¾x5	33.7	Pb	Zen	Vac	Aut	Br-L	U	5	Own	R	58.5	4	D	161	7200	36x6	D40x8
Relay Series 60	3	4595	Bud B A 6	6	4 x5⅛	40.8	Pb	Zen	Vac	Aut	Ful	U	5	Own	R	63.7	4	D	175	7500	36x6	D38x7
Relay Series 80	3	5330	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	U	8	Own	R	84.18	4	D	175	8400	36x6	S40x10
Relay Series 60	3½	4745	Bud B A 6	6	4 x5⅛	40.8	Pb	Zen	Vac	Aut	Ful	U	5	Own	R	58.5	4	D	175	7800	38x7	D40x8
Relay Series 80	3½	5330	Bud B A	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Cov	C	8	Own	R	84.18	4	D	175	8600	36x6	S40x12

Major Specifications and Mechanical Details of 1930 Commercial Cars Built in the United States

Make and Model	Capacity—Tons	Chassis Price	Engine	No. of Cyl.	Bore and Stroke	Tax H. P.	Oil System	Carburetor	Fuel Feed	Ignit. System	Gear Set	Location	No. Spds. For.	Rear Axle	Final Drive	Reduction in Low	Brakes, Foot	Brakes, Hand	Standard Wheel Base	Chassis Weight	Standard Tire Sizes Front	Rear
Relay Series 80	4	5380	Bud B A	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Cov	C	8	Own	R	84.18	4	D	175	8800	38x7	S40x14
Relay Series 100	5	6615	Con 21 R	6	4⅜x4¾	45.9	Pb	Str	Vac	Aut	Ful	U	5	Own	R	63.7	4	D	230	10000	9.00x24	D9.75x24
Reo D F 129	½	1095	Own	6	3⅜x5	27.3	Pb	Sch	P	DR	Own	U	3	Own	Sp	17.1	4	Tr	129	——	6.00x20	32x6
Reo 15 Junior	½	785	Con 19 E	6	3⅜x4	27.3	Pb	Sch	P	DR	W-G	U	3	Sal	Sp	14.63	4	Tr	115	2290	6.00x18	6.00x18
Reo D F	1	1095	Own C B	6	3⅜x5	27.3	Pb	Sch	P	DR	Own	U	3	Own	Sp	17.1	4	Tr	135	3200	6.00x20	32x6
Reo F A	1½	1295	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	34.32	4	Tr	137	3525	6.00x20	32x6
Reo F E	1½	1395	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	34.32	4	Tr	152	3700	6.00x20	32x6
Reo F F	1½	1395	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	34.32	4	Tr	156	3750	6.00x20	32x6
Reo F H	2	1595	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	37.6	4	Tr	142	4165	32x6	32x6D
Reo F C	2	1645	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	37.62	4	Tr	152	4025	32x6	32x6D
Reo F D	2	1745	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	37.62	4	Tr	168	4075	32x6	32x6D
Reo G A	3	2035	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	41.05	4	Tr	163	4625	32x6	32x6D
Reo G C	3	2140	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	41.05	4	Tr	179	4850	32x6	32x6D
Reo G D	3	2085	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	78.1	4	Tr	144	4570	32x6	32x6D
Reo G C S	3	2375	Own	6	3⅜x5	27.3	Pb	Sch	Vac	DR	Own	U	4	Own	Sp	41.05	4	Tr	210	5320	32x6	32x6D
Rugby T	½	655	Con	6	3¼x4	25.4	Pb	Str	P	Aut	Own	U	3	Own	Sp	15.6	4	4	——	2160	29x5	29x5
Rugby 6-15	1	865	Con	6	3¼x4	25.4	Pb	Str	P	Aut	Br-L	U	4	Sal	Sp	34.49	4	Tr	135	2900	20x5.50	32x6
Rugby 615	1½	930	Con	6	3¼x4	25.4	Pb	Str	P	Aut	Br-L	U	4	Sal	Sp	34.49	4	Tr	135	3000	5.50x20	30x5D
Selden 7 C	1	1098	Con	6	2⅝x4¾	19.84	Pb	Zen	Vac	Aut	Br-L	U	3	Tim	Sp	—	4	D	124	3600	30x5	30x5
Selden 17 C	1½	1500	Con	6	3⅜x4	27.3	Pb	Zen	Vac	Aut	Br-L	U	4	Tim	Sp	—	4	D	142	3000	32x6	32x6
Selden 317 C	1½	1610	Con	6	3⅜x4⅝	27.34	Pb	Str	Vac	Aut	Br-L	U	4	Tim	Sp	—	4	D	142	3900	32x6	32x6
Selden 37 C	2	1935	Con	6	3⅜x4⅝	27.34	Pb	Str	Vac	Aut	Br-L	U	4	Tim	Sp	—	4	D	151	4800	32x6	32x6D
Selden 39 C	2½	2920	Con	6	4 x4½	38.4	Pb	Str	Vac	Aut	Br-L	U	4	Tim	Sp	—	4	D	164	5800	32x6	32x6D
Selden 47 C B	3½	3785	Con	6	4 x4½	38.4	Pb	Str	Vac	Aut	Br-L	U	4	Tim	Sp	—	4	D	171	7200	34x7	34x7D
Selden 47 C D	4	4435	Con	6	4 x4½	38.4	Pb	Str	Vac	Aut	Br-L	U	5	Wis	2R	—	4	D	171	7600	36x8	36x8D
Selden 67 C	5	4975	Con	6	4⅜x4¾	45.94	Pb	Str	Vac	Aut	Br-L	C	7	Wis	2R	—	4	D	171	8700	36x8	36x8D
Selden 77	7	7365	Con	6	4¾x5¾	54.15	Pb	Str	Vac	Aut	Br-L	C	7	Wis	2R	—	4	D	178	12000	36x7	40x7D
Service Series S 11	2	2030	Bud H S 6	6	3⅜x4½	27.3	Pb	Zen	Vac	Aut	Br-L	U	4	Tim	Sp	29.2	4	D	162	4500	32x6	D32x6
Service Series 40	2	3240	Bud D S 6	6	3⅝x5	31.5	Pb	Zen	Vac	Aut	Br-L	U	4	Tim	Wo	34.8	4	D	168	4900	36x6	D36x6
Service Series 40	2½	3240	Bud D S 6	6	3⅝x5	31.5	Pb	Zen	Vac	Aut	Br-L	U	4	Tim	Wo	34.8	4	D	168	5100	36x6	D36x6
Service Series 60	2½	4580	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Ful	U	5	Tim	Wo	63.0	4	D	175	7000	36x6	36x6
Service Series 60	3	4680	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Ful	U	5	Tim	Wo	63.0	4	D	175	7100	36x6	D38x7
Service Series 80	3½	5250	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	C	7	Tim	Wo	98.2	4	D	175	8200	S36x6	S36x12
Service Series 80	4	5330	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	C	7	Tim	Wo	98.2	4	D	175	8400	S36x6	S36x14
Service Series 100	5	5830	Bud B A 6	6	4⅛x5⅛	40.8	Pb	Zen	Vac	Aut	Br-L	C	7	Tim	Wo	95.0	4	D	175	9600	S36x6	S40x14
Stewart 30	1	695	Lyc AFE	4	3¾x4½	22.5	Pb	Str	Vac	DR	W-G	U	4	Sal	Sp	35.1	4	D	130	2905	6.50x20	6.50x20
Stewart 30 X	1	795	Lyc WRG	6	2⅞x4¾	19.8	Pb	Str	Vac	DR	W-G	U	4	Sal	Sp	35.1	4	D	130	2965	6.50x20	6.50x20
Stewart 40	1½	895	Lyc AFE	4	3¾x4½	22.5	P	Str	Vac	DR	W-G	U	4	Cla	Sp	35.1	4	D	130	3215	6.50x20	6.50x20D
Stewart 40X	1½	995	Lyc WTG	6	3 x4½	23.8	Pb	Str	Vac	DR	W-G	U	4	Sal	Sp	35.1	4	D	130	3250	6.50x20	6.50x20D
Stewart 34 X	1½	1195	Lyc 4 SL	6	3¼x4½	25.3	Pb	Str	Vac	DR	W-G	U	4	Cla	Sp	35.1	4	D	145	3526	6.50x20	6.50x20
Stewart 28 X	1¾	1495	Lyc 4 SL	6	3¼x4½	25.3	Pb	Str	Vac	DR	Ful	U	4	Cla	Sp	44.1	4	D	136	3840	6.50x20	6.50x20
Stewart 29XS	2	1695	Lyc ASA	6	3⅜x4½	25.3	Pb	Str	P	DR	Ful	U	4	Cla	Sp	44.1	4	D	145	4188	32x6	32x6D
Stewart 26 XW	2	2290	Lyc TF	6	3⅝x5	31.5	Pw	Str	Vac	DR	Ful	U	4	Tim	Wo	48.1	4	D	165	5095	32x6	32x6D
*Stewart 18 X	2½	2690	Lyc TF	6	3⅝x5	31.5	Pw	Str	Vac	DR	Ful	U	4	Tim	Wo	48.1	4	D	165	5788	32x6	32x6D
Stewart 32 X	2½	1990	Lyc ASA	6	3⅝x4½	31.54	Pw	Str	Vac	DR	Ful	U	4	Cla	Sp	46.1	4	D	165	5100	32x6	32x6D
Stewart 35 X	3	2590	Lyc AFD	6	3¾x4½	33.8	Pw	Str	P	DR	Ful	U	4	Cla	Sp	46.1	4	DR	165	5800	8.25x20B	8.25x20D
Stewart 33 X	3	3290	Lyc TS	6	3⅞x[illegible]	36.2	Pw	Str	Vac	DR	Ful	U	4	Tim	Wo	105.1	4	D	165	6450	34x7	34x7D
Stewart 19 X	3½	3690	Lyc TS	6	3⅞x5	36.2	Pw	Str	Vac	DR	Ful	C	12	Tim	Wo	105.1	4	D	165	6990	36x5	36x10
Stewart 31 X	5	4990	Wak 6 RSL	6	4⅜x5⅛	45.9	Pw	Str	Vac	DR	Ful	C	8	Tim	Wo	82.1	4	D	165	8400	36x6S	36x6SD
Stewart 27 X	6-7	5700	Wak 6 RSL	6	4⅜x5⅛	45.99	Pw	Str	Vac	DR	Ful	U	8	Tim	Wo	93.81	4	D	165	9927	36x7	40x7D
Studebaker GN-P	¾	845	Own	6	3⅜x4⅛	27.3	Pb	Str	P	DR	Own	U	3	Own	Sp	15.15	4	‡4	115	2465	6.00x19	6.00x19
Studebaker GN-S	1	1045	Own	6	3⅜x4⅛	27.3	Pb	Str	P	DR	Own	U	3	Own	Sp	13.8	4	D	130	2990	6.00x20	30x5
Studebaker GK-N	1	1095	Own	6	3⅜x4⅛	27.3	Pb	Str	P	DR	Own	U	3	Own	Sp	13.8	4	D	146	3000	30x5	30x5
Studebaker S-20	1½	695	Own	6	3¼x4⅛	25.4	Pb	Str	P	DR	W-G	U	4	Tim	Sp	36.2	4	4	130	3000	6.00x20	32x6
Studebaker S-30	1½	775	Own	6	3¼x4⅛	25.4	Pb	Str	P	DR	W-G	U	4	Tim	Sp	36.2	4	4	160		6.00x20	32x6
Studebaker S-50	2	895	Own	6	3¼x4⅛	25.4	Pb	Str	P	DR	W-G	U	4	Tim	Sp	37.4	4	4	148		6.50x20	6.50x20D
Studebaker S-60	2	945	Own	6	3¼x4⅛	25.4	Pb	Str	P	DR	W-G	U	4	Tim	Sp	37.4	4	4	160		6.50x20	6.50x20D
Studebaker GN-N	*4000	1245	Own	6	3⅜x4⅛	27.3	Pb	Str	P	DR	Cla	U	4	Cla	Sp	33.5	4	D	146	3265	30x5	32x6
Studebaker 77	*12500	2895	Own	8	3½x4⅜	39.2	Pb	Str	P	DR	Ful	U	4	Eat	Sp	24.6	4V	D	158	5030	7.00x20	7.00x20D
Studebaker 88	*12500	3295	Own	8	3½x4⅜	39.2	Pb	Str	P	DR	Ful	U	4	Eat	Sp	24.6	4V	D	184	5200	7.50x20	7.50x20D
Studebaker 99	*14000	3795	Own	8	3½x4⅜	39.2	Pb	Str	P	DR	Ful	U	4	Eat	Sp	24.6	4V	D	184	5680	7.50x20	7.50x20D
Whippet 96 A	½	360	Own 96 A	4	3⅛x4⅜	15.6	Pb	Til	Vac	Aut	Own	U	3	Own	Sp	14.74	4	B	103½	1665	4.75x19	4.75x19
White 15 B		1545	Own GKA	4	3¾x5⅛	22.5	CS	Zen	Vac	L-N	Own	C	4	Own	Sp	18.6	R	R	133½	3402	30x5	30x5
White 60		1850	Own 2 A	6	3½x4½	29.4	Pw	Zen	Vac	DR	Own	U	3	Own	Sp	17.9	4	D	138	3739	30x5	30x5
White 57		2725	Own GRC	4	4 x5¾	25.6	Pw	Zen	Vac	L-N	Own	U	4	Own	Sp	19.3	R	R	146	3935	32x6	32x6
White 20 A		2125	Own GKA	4	3¾x5⅛	22.5	CS	Zen	Vac	L-N	Own	C	4	Own	2R	32.1	R	R	145½	4572	34x5	34x5D
White 61		2450	Own 4 A	6	3¾x4½	33.75	Pw	Zen	Vac	DR	Own	U	4	Own	Sp	23.4	4	D	148	4789	30x5	30x5D
White 56		3125	Own GRC	4	4 x5¾	25.6	Pw	Zen	Vac	Mag	Own	U	4	Own	Sp	26.2	R	D	165	5276	36x4S	36x7S
White 51 A		3750	Own GRB	4	4¼x5¾	28.9	Pw	Zen	Vac	Mag	Own	U	4	Own	Sp	35.6	R	D	170	6438	36x5S	36x9S
White 58		4400	Own GRB	4	4¼x5¾	28.9	Pw	Zen	Vac	Mag	Own	U	4	Own	IG	49.7	D	R	170	6438	36x5S	36x9S
White 56		4650	Own GRB	4	4¼x5¾	28.9	Pw	Zen	Vac	Mag	Own	U	4	Own	IG	66.1	D	R	174	8737	36x5S	40x5SD
White 52 T		4700	Own GRB	4	4¼x5¾	28.9	Pw	Zen	Vac	Mag	Own	U	4	Own	IG	76.5	D	R	129½	8461	36x5S	40x5SD
White 52		5100	Own GRB	4	4¼x5¾	28.9	Pw	Zen	Vac	Mag	Own	U	5	Own	IG	92.3	D	R	174	9409	36x6S	40x12S
White 59 A		6000	Own 3 A	6	4 x5¼	38.4	Pw	Zen	P	DR	Own	U	4	Own	Sp	66.5	D	R	155	9775	40x8	40x14S
White 63		5000	Own 3 A	6	4 x5¼	38.4	Pw	Zen	P	DR	Own	U	4	Own	Sp	41.4	4	D	168	8350	34x7P	34x7DP
White 64		6300	Own 1 A	6	4⅜x5¾	45.94	Pw	Zen	P	LN	Own	U	4	Own	2R	46.8	4	D	180	9154	36x8P	36x8DP
Willys Six 98 B	½	525	Own 98 B	6	3¼x3⅞	25.35	Pb	Til	Vac	Aut	Own	U	3	Own	Sp	14.28	4	B	110	1904	5.50x19	5.00x19
Willys Six C-101	1½	695	Own 98 B	6	3¼x3⅞	25.35	Pb	Til	Vac	Aut	Own	U	4	Cla	Sp	42.33	4	B	131	2740	5.50x20	30x5
Willys-Knight T-103	1½	825	Own KGT	6	2⅛x4⅜	20.7	Pb	Til	Vac	Aut	Cov	U	4	Cla	Sp	42.33	4	B	131	2848	5.50x20	30x5

GENERAL NOTATIONS

***†REFFRENCE MARKS** apply to individual lines only and explanations are given under the subdivision for each company in the "SPECIAL NOTATIONS."

CAPACITIES given in this table are in tons or fractions of tons. *Shows maximum allowable gross weight in pounds.

WHEEL BASES given are standard, but optional wheel bases are available in many cases.

ENGINE—Bud, Buda; Con, Continental; Her, Hercules; Kgt, Knight; Lyc, Lycoming; Wak, Waukesha; Wis, Wisconsin; Hall, American Car & Foundry.

LUBRICATION—Pb, pressure lubrication to main and connecting rod bearings; Pw, full pressure lubrication to all main, connecting rod and camshaft bearings, including wrist pins; CS, circulating splash; Sp, splash.

CARBURETOR—Car, Carter; Mar, Marvel; Sch, Wheeler-Schebler; Str, Stromberg; DL, Detroit Lubricator; Til, Tillotson; Zen, Zenith-Detroit.

FUEL FEED—Gra, Gravity; Vac, Vacuum tank; P, Fuel pump

IGNITION—AB, American-Bosch; Aut, Electric Auto-Lite; Eis, Eisemann; L-N, Lorce-Neville; N-E, North East; RB, Robert Bosch; DR, Delco-Remy; Mag, Magneto

TRANSMISSION—Br, L, Brown-Lipe; Cov, Covert; Ful, Fuller; Mec, Mechanics Machine; Mun, Muncie; W-G, Warner Gear; Cotta, Cotta Gear Company.

LOCATION—C, center, amid; U, in unit with engine; J, on jackshaft.

REAR AXLE—Cla, Clark Equipment; Col, Columbia; Eat, Eaton; Sal, Salisbury; Tim, Timken; Wis, Wisconsin.

FINAL DRIVE—IG, Internal gear; St, Straight bevel; Sp, Spiral bevel; Wo, Worm; 2R, Double reduction; Ch, Chain; R Relay drive.

BRAKES—J, Jackshaft; R, Rear wheels; D, Drive shaft; 4, four-wheel; Tr, Transmission; V, Vacuum booster; W, Westinghouse air brake; B, Both front and rear wheels.

TIRES—B, Balloon; D, Dual; S, Solid; P, Pneumatic

SPECIAL NOTATIONS

AMERICAN-LA FRANCE

*Chief model also available as 2½-ton model, 34x7 tire, dual rear, weight 6,400. Price $3,900.

Chieftain model also available as Dump Truck, 160-inch wheel base.

Balloon tires optional on Chief, Chieftain and Big Chief models.

AUSTIN

*Price announced in forthcoming issue.

AUTOCAR

*Engines in these models are located under the driver's seat.

DIAMOND T.

Myers Magazine oiling system for chassis optional equipment.

DURANT LINE

*Price includes panel body.

DODGE

Dodge Model F 36 A to D is available on 165-inch wheel base. Model F 41 A to E is available on 165-inch wheel base. Model F 61 A to E is available on 170-inch wheel base. Model F 62 A to E is available on 195-inch wheel base. F 40 A, F 60A, F 61 A, optional carburetor, Detroit-Lubricator.

F. W. D.

*Indicates six-wheel model. Special power take-off transmission, which provides 3 power take-offs which may be operated in any transmission speed, optional on all models.

*Foot brake on X6 is a Lockheed type, operating on all six wheels.

FEDERAL

*Six wheelers.

GRAMM

Series 6	Straight Rating	Add. Wheel Base	Pay Load Range
B	10,000	157-174	1¾ tons
C	11,000	145-196	2 tons
D	13,000	145-196	2½ tons
E	15,000	145-196	3 tons

GENERAL MOTORS TRUCK LINE

*Capacity indicated for each chassis is the recommended gross weight without exceeding rated capacity of tires. The tire size does not affect the straight rating for which chassis is guaranteed and each model is designed to operate satisfactorily under average conditions with loads giving a total gross weight (chassis, body, equipment and payload) equal to straight rating given below. The additional standard wheel base lengths, the number of additional tire types (tire combinations—each type carrying a recommended gross weight) and the ton range on a nominal pay-load basis for each model is given below.

Model	Straight Rating	Additional Wh. bases, ins.			Addit'l Tire Types	Pay'l'd Range
T-11	3800	None			None	½
T-15	5400	141			2	¾
T-17	6500	141			6	¾-1¼
T-19	8500	141		151	20	1-2
T-25	8500	141		152	15	1-1¾
T-30	11000	152		164	13	1½-2½
T-42	14000	152	164	181	10	2-3½
T-44	15000	152	164	181	10	2-4
T-60	18500	166¾	184½	200¼	16	2½-4½
T-82	22000	167½	185½	201	10	3-6
T-90	28000	201		220	5	5-7½

Optional rear axle ratios are available for all models.

MACK LINE

Other wheel bases furnished on all truck models.

On 6-wheel jobs, 4 rear wheels driven by chains, foot brake on 4 rear wheels.

HYP—Hypoid drive, single reduction.

††Made also in tractor models.

REO LINE

Model F A also available in 129-inch wheel base.

RUGBY

F—Chassis weight includes body.

STEWART LINE

Model 30 and 30X can also be supplied in 129 and 140-inch wheel base.

Model 40 can also be supplied in 140 and 160-inch wheel base.

*Model 34X can be supplied in 145, 160 and 176-inch wheel base.

Model 29X can be supplied in 145, 160 and 176-inch wheel base.

Model 29XS can be supplied in 160 and 176-inch wheel base.

*Model 26XW can be supplied in 148, 176 and 190-inch wheel base.

*Models 18X, 32X and 33X can be supplied in 148, 190 and 220-inch wheel base.

*Models 19X, 31X and 27X can be supplied in 148 172, 190, 220 and 235-inch wheel base.

As optional equipment models 18X, 19X, 33X, 31X and 27X can be supplied with Timken dual reduction rear axle.

STUDEBAKER LINE

*Capacity model GN-N is 4,000 pounds for body, cab, driver and payload.

Maximum gross load, chassis, body and payload for Models 77 and 88 is 12,500 lbs. and for Model 99 is 14,000 lbs.

‡Hand brake same as foot brake, standard. Hand brake on drive shaft, special equipment.

WILL USE BILLBOARDS

Reno, Nev., Sept. 25 (UTPS).—Herbert Woodward, Inc., Reo distributor for Nevada, Arizona and southern California, with headquarters in Los Angeles, is to launch an intensive advertising campaign, using newspapers, outdoor billboards and the radio, the campaign to start before the middle of October. The Mayers Company, a Los Angeles advertising agency, is to direct the campaign.

Scaling of Steel at Forging Temperatures

(Continued from Page 7)

the steel has been placed in the furnace, its temperature soon becomes so hot as to volatilize the iron oxide that is formed. The temperature registered by the thermocouple was above 2550 degrees Fahr. It increased so rapidly that it was scarcely possible to keep pace with the potentiometer reading. Since the thermocouple was separated from the piece by a refractory protection tube, it is impossible to know the actual temperature of the steel sample. There is evidence of the sample becoming hotter than the furnace atmosphere at 2300 degrees Fahr., but the temperature is not sufficiently high to initiate the reaction observed at 2375 degrees Fahr. At 2350 degrees Fahr. the heat generated was sufficient to cause the temperature in the tube to rise above 2400 degrees Fahr., but apparently the scale formed before the sample reached the temperature of very rapid reaction acted as a protecting agent. However, when a clean sample was placed in the tube at 2375 degrees Fahr. the combination with oxygen was so rapid that the sample became white hot and then burned completely to iron oxide. The iron oxide was volatilized and appeared as a dense smoke. It diffused through to the inside of the thermocouple refractory protection tube as was shown by the deposit of iron oxide on the inside of the tube. The thermocouple wires were contaminated and had to be cut back about two inches from the end and rewelded. This contamination of thermocouple wires was similar to that reported by one of the authors in connection with a study of the burning of steel.

Steam

The action of steam on scaling was investigated to determine the effect of rate of flow of the steam, the effect of variations in temperature, the effect of time of exposure and the effect of admixture with nitrogen.

The steam was prepared from distilled water freshly boiled to eliminate dissolved gases.

The results of the tests on the effect of variation of the rate of flow show that the amount of scale produced at two feet per minute is more than three times the amount produced when the steam is still.

Further, at a rate of flow of fifteen feet per minute, the amount of scale produced is more than double that at two feet per minute. Varying the rate of flow from fifteen feet to thirty feet per minute appears to cause a very small increase in the amount of scale, and from thirty to sixty feet there appears to be a slight increase. Increasing the rate of flow from 60 to 172 feet per minute causes no increase in the amount of scaling. The only test made at 172 feet per minute was made in a steel tube during the early work in this study. It is believed that at this high rate of flow the effect of the steel tube is practically negligible.

It will be observed from Fig. 4 that increase in temperature causes a large increase in the rate of scaling. At 2400 degrees Fahr., more than three times as much scale is formed in the same period of time as is formed at 2000 degrees Fehr. When the temperature is increased to 2500 degrees Fahr., the rate of scaling is very rapid, so rapid, in fact, that the hydrogen generated by the reaction burns with a steady flame at the crevices between the front plug and the tube. So much scale was formed in a period of twenty minutes that the run was discontinued at this time because it was feared that the tube would be burned out from the action of the iron oxide. For the 2500-degree Fahrenheit test, the sample was placed on a specially constructed boat made of "chrompatch" with sillimanite cross bars and so supported that it touched the cross bars at only two points in the same manner as that described for the high temperature air tests. After the twenty-minute test, the chrompatch boat was found to be fused and disintegrated. The porcelain tube, however, remained in fair condition. It was found that the oxide had fused and run off the steel, so that it presented clean steel continuously to the action of the steam. It is believed that the fusion of the scale permitting a fresh surface to be continuously brought in contact with the steam was the prime cause for the very marked increase in the rate of scaling at 2500 degrees Fahrenheit.

The effect of variation of time of exposure on scaling in steam at 2300 degrees Fahrenheit shows an increase in the amount of scale produced with increasing time, as was expected. The rate of scaling, however, decreases with increase in time of exposure. This is shown graphically in Fig. 5. The equation for this curve has been found to be $W^2 = 0.01552t - 0.2695$ where W is the loss in weight per 100 square inches and t is the time of exposure in minutes.

Mixtures of nitrogen and steam were passed over the steel in order to study the effect of the action of steam under reduced pressure. Since nitrogen is known not to scale steel, diluting steam with nitrogen would, of course, have the effect of reducing the pressure of steam. The nitrogen used was the commercial tank nitrogen. For producing the mixture from 1 to 10 per cent., the nitrogen was passed through the humidifier. For mixtures from 15 to 50 per cent. steam, the steam from the boiler was mixed with the nitrogen. It may be seen from Fig. 6 that decreasing the vapor pressure of the steam decreases the rate of scaling of the steel.

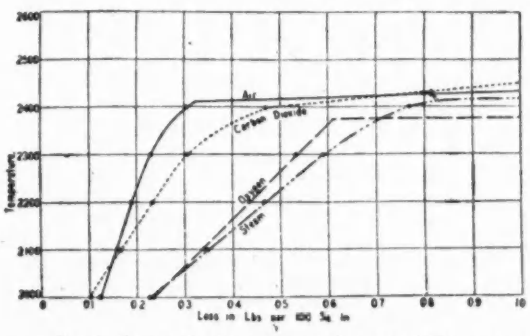


Fig. 4—Curves Showing Effect of Variation of Temperature on Scaling of Steel.

Carbon Dioxide

The carbon dioxide used in these tests consisted of the commercial tank carbon dioxide which was found to vary in composition from 99.85 to 99.95 per cent. carbon dioxide. Tests were made to determine the effect of rate of flow of this gas on scaling at 2300 degrees Fahrenheit, the effect of variation in temperature, the effect of time of exposure and the effect of decreasing the pressure.

The effect of variation of rate of flow of carbon dioxide at 2300 degrees Fahrenheit seems to parallel the effect produced with air and steam. The amount of scale produced at zero rate of flow is less than one-third that produced when the rate of flow was two feet per minute. Increasing the rate of flow from two to ten feet per minute causes a small increase in the amount of scale. From ten feet to 570 feet per minute, no change in the amount of scaling is obtained.

The rate of scaling is more than four times as rapid at 2400 degrees Fahrenheit as that at 200 degrees Fahrenheit. The tests at 2500 degrees Fahrenheit show a very decided increase in the amount of scale produced.

Variation of time of exposure to carbon dioxide at 2300 degrees Fahrenheit shows the same general tendency as is shown by air and steam, that is, the amount of scale increases with time of exposure, but the rate of scaling decreases with time of exposure.

The results obtained when carbon dioxide was diluted with nitrogen and passed over steel at 2300 degrees Fahrenheit indicated a decrease in scaling.

Comparison of the Action of the Gases Tested

A comparison of the scaling effect of the four gases, air, oxygen, steam and carbon dioxide, may be made by reference to Fig. 4. The points for carbon dioxide and steam at 2500 and air at 2475 degrees Fahrenheit were obtained by 20-minute exposures instead of the 40-minute exposures used for the rest of the tests presented in this figure. The curves were therefore not drawn to these points and the slope of the curve is for this reason estimated beyond 2400 degrees Fahrenheit. It will be observed that the air curve and carbon dioxide curve cross in two points, just a little below 2300 degrees Fahrenheit and at 2425 degrees Fahrenheit. The crossing at 2425 degrees Fahrenheit is, the authors believe, due to the exothermic reaction between air and steel generating so much heat that the sample becomes hotter than the furnace atmosphere. No such reaction occurs with carbon dioxide so that its curve follows the normal course. It is of interest to note that between the temperature of 2000 and 2300 degrees Fahrenheit, each one of the curves is a straight line.

It was surprising to find steam such an active oxidizer at these temperatures. Reference to Fig. 4 shows that practically the same amount of scale is produced with pure steam as with pure oxygen between the temperature 2000 and 2300 degrees Fahr. However, at 2375 degrees Fahr. oxygen shows its superiority to steam by causing 100 per cent. conversion of iron to iron oxide in ten minutes' time, whereas steam at 2400 degrees Fahr. causes 16.1 per cent. conversion in forty minutes' time. This sudden increase in the rate of oxidation caused by pure oxygen is primarily due to the exothermic reaction already referred to. The heat generated when steel is placed in the furnace at this temperature is sufficient to cause a fusion of the oxide and then, because of the continued rapid oxidation of the thus unprotected steel, causes the melting of the steel itself. If the steel is allowed to become coated with solid oxide at temperatures such as 2325 or 2350 degrees Fahr. it can then be heated to 2400 degrees Fahr. without initiating the fast rate of oxidation that causes fusion of the sample. This shows the protective action of the oxide scale. This protecting action of the oxide formed is also evidenced by the decreasing rate of oxidation with increased time of exposure, as may be observed in Fig. 5. The protecting action of the scale formed on the steel is of considerable importance. Its physical and chemical composition will determine, in part, the rate of oxidation of the steel. The physical characteristic of the scale chiefly affecting the rate of scaling is, we believe, its permeability to the scaling gases.

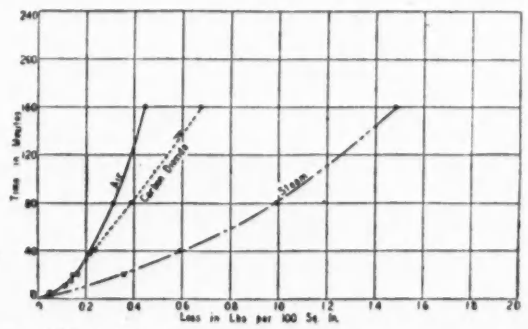


Fig. 5—Curves Showing Effect of Period of Exposure on Scaling of Steel at 2300 Degrees Fahr.

There is a distinct difference in the appearance of the oxides formed by the different gases. The scale formed with steam has a well-developed structure having a coarsely crystalline, shiny appearance. The surface that is formed at 2800 degrees Fahr, is very rough, and, when quenching, the scale peels off the steel in relatively large pieces. The scale formed with carbon dioxide resembles in crystalline form that produced with steam. It is not quite so coarse and, upon quenching, splits off the steel in rather finer flakes. It would appear to have a higher melting point, since it does not fuse off the steel at 2500 degrees Fahr., whereas the scale formed with steam does fuse at this temperature. The scale produced in air or in oxygen has a smooth, glossy appearance and shows no grain structure.

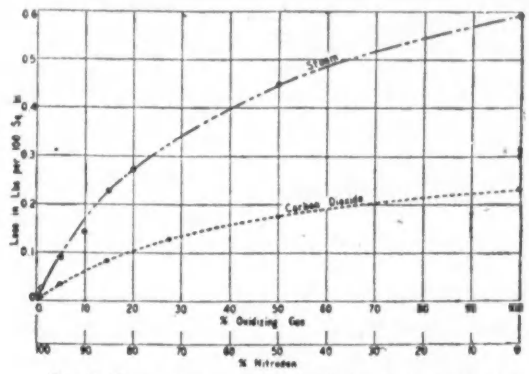


Fig. 6—Curves Showing Effect of Dilution of Oxidizing Gases with Nitrogen on Scaling of Steel.

In addition to the difference in physical appearance there seems to be a distinct difference in chemical composition of the scale formed in the different atmospheres. When the average loss in weight per 100 square inches is divided by the average weight of scale per 100 square inches the result should approximate the average iron content of the scale. For some reason unknown to the authors these ratios, when carbon dioxide or steam is used, are much more constant than when air or oxygen is the scaling medium. For air, the iron content is reasonably close to that of Fe_2O_3, but for steam and carbon dioxide the ratios indicate a composition very near FeO. In order to check further the iron content indicated by these ratios chemical analyses for total iron were made on a few typical samples of scale produced with the different atmospheres.

It is evident from the agreement of the ratios in all of the data obtained and from these chemical analyses of typical scales that the average iron content of scale found in air approaches that of Fe_2O_3 and the average iron content of scale found in carbon dioxide or steam approaches that of FeO. Apparently the chemical as well as physical characteristics of the scale depend on the atmosphere employed.

The mechanism of oxidation with air, as postulated by Pfeil, seems to be in agreement with the results obtained in this investigation for air. Pfeil's mechanism of oxidation consists of the inward diffusion of oxygen and the outward diffusion of iron through the scale. It is at once evident that as the thickness of the scale increases the rate of oxidation will decrease, due to the necessity of both the oxygen and iron diffusing through thicker layers.

The effect of rate of flow of the air seems to be at least in part due to the diffusion rate of the oxygen through the scale. When the oxygen is not supplied rapidly enough to replace that removed by diffusion through the scale, a certain reduced rate of oxidation occurs, determined by the rate at which the oxygen is supplied. This is in part a matter of the oxygen concentration of the gas immediately surrounding the sample. When the oxygen is supplied faster than it can be removed by the diffusion of oxygen through the scale no more rapid rate of oxidation can occur. In other words, rates of flow greater than that necessary to balance the rate of diffusion will cause no increase in the oxidation rate. This is precisely what has been observed in the tests. This rate would be expected to vary with variations in temperature and would probably increase with increase in temperature due to the probably greater speed of diffusion of the oxygen through the oxides at the higher temperature.

In the case of the scaling with steam, there is a question as to what occurs. The molecular water may diffuse through the scale and finally decompose into hydrogen and oxygen, after which the oxygen is fixed and the hydrogen must diffuse back out; or the molecule of water may be broken up at the outer surface of the scale, forming atomic oxygen which could diffuse much more easily or possibly forming molecular oxygen which would diffuse more slowly. Certainly the appearance and looseness of structure of the scale formed with steam is very different from that formed with air or that formed with oxygen. The scale formed with air had an appearance similar to that of scale formed with oxygen. Whether the crystal structure or the composition of the scale differed remains to be determined.

Similarly, the mechanism of the reaction with carbon dioxide requires further investigation. Here it is a question whether the carbon dioxide gas diffuses through the scale to the surface of the steel, or breaks up into carbon monoxide and oxygen at the surface of the scale after which the atomic, or perhaps molecular, oxygen diffuses through the scale toward the iron. The appearance of the scale resembles that produced by the steam, but a much smaller quantity is formed under similar conditions of temperature, time, and rate of flow.

The effect of variation in the rate of flow of the three gases, air, carbon dioxide, and steam, on scaling is quite similar, as may be observed from Fig. 2. In the case of all three gases, the most decided difference in rate of scaling is produced between zero and two feet per minute. With air there is only a slight increase in the rate of scaling produced at six feet per minute and no change in the rate of scaling by increase in the rate of flow beyond this value. With carbon dioxide the scaling rate is affected somewhat by increasing the rate up to ten feet per minute, and increasing the rate of flow beyond this point does not affect the scaling rate. With steam, the change in rate of scaling is more gradual, increasing to thirty feet per minute. Increasing the rate of flow from 30 to 60 feet per minute causes a very slight increase in scaling, and beyond 60 feet per minute there is no additional increase in scaling rate. It is noteworthy in the case of each of the gases that beyond 60 feet per minute there is no effect from increasing the rate of flow. While this is only strictly true at 2300 degrees Fahr. it is expected that the same general behavior would be observed at other temperatures at which different values would be found for the point of minimum rate of flow beyond which no increase in rate of scaling is produced by increasing the rate of flow.

Comparing the effect of time of exposure at 2300 degrees Fahrenheit, as shown in Fig. 5, it will

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H. J. FRENCH RECEIVES HIGHEST METAL AWARD

(Continued From Page 1)

bell memorial lecture, generally regarded as the principal talk at the annual convention. By custom this lecture is given by a leading metallurgist, who has not previously appeared in a like capacity. The honor to Dr. Grossman is especially significant since he is the youngest man ever to deliver this important address. He is 33 years old and curiously enough he was introduced by the oldest metallurgist in America, Dr. Albert Sauveur, Gordon McKay professor of metallurgy of Harvard University, and known as the dean of his profession. Dr. Sauveur delivered the Campbell lecture last year.

Dr. Grossman is vice-president and director of the Republic Research Company of Canton, O., the research subsidiary of the Republic Steel Corporation of Youngstown, O. His subject was "Oxygen in Steel," and delivery of his address met with an enthusiastic reception.

Next year's national metal week will be held in Boston, from September 21 to 25, it was made known by W. H. Eisenman, secretary of the American Society for Steel Treating. Headquarters for the congress will be in the Statler Hotel and the exposition will be staged at Commonwealth Pier, where it was held in 1924. Participating groups have not yet been announced.

The discussion of "Radiography by the Use of Gamma Rays," by R. F. Mehl and C. S. Barrett of the Naval Research Laboratory and G. E. Doan of Lehigh University drew a big audience, and proved fascinating to members attending. They followed with interest the recital of work done through radion used in taking pictures of action within the working parts of automobiles.

At the technical session of the American Welding Society the discussion of fabrication of corrosion-resisting steel and aluminum came in for prominence, while the shop practice session of the American Society of Mechanical Engineers brought out much of interest in reports on the manufacture and industrial applications of phenol materials.

From the headquarters of the American Institute of Mining and Metallurgical Engineers it was announced that younger members will have an opportunity to win prizes amounting to $100 for first and $50 for second, to be awarded for the best technical papers presented at the Chicago section of the institute. Conditions are that the authors shall not have reached their 31st year by January 1. The awards are known as the Sykes and Wright prizes.

Agitation has already been started to make the newly introduced sales sessions a regular annual part of the programs. This new feature has met with instant and unexpected popularity, as shown by the overflow crowd which necessitated installation of loud speakers for those who could not gain their way into the meeting room.

Previous attendance marks at the big metal exposition are destined to be surpassed this year, according to a check-up made at the show.

Visits to the Crane Company, Chicago Steel Foundry Company, Liquid Carbonic Corporation, American Force Company, Sivyer Steel Castings Company and the tractor works of International Harvester Company drew many members.

MESKER SEES REAL GAINS IN BUSINESS

(Continued from Page 1)

of the Diamond division of Aluminum Industries at St. Cloud, Minn., in Cincinnati last week for a conference with officials, regarding plant expansion, said new accounts opened up throughout the West and orders being received already show an increase of 33 1-3 per cent. over September, 1929, necessitating increased manufacturing space to comply with replacement requirements.

MARMON CAR SALES IN SEPTEMBER TO SHOW 100% GAIN OVER AUGUST

Indianapolis, Sept. 25.—An important indication of business revival is reported by the Marmon Motor Car Company through announcement by George C. Tenney, general sales director, that September shipments of Marmon straight eights will not only exceed by more than 100 per cent. the total of August this year, but will be larger than the total in September, 1929.

It is practically assured that the September total of Marmon shipments will give the best month since last April, Mr. Tenney said. The Marmon factory is being operated on a full-time basis in most departments and at a rate of greatly increased activity in others.

Retail sales totals likewise have been given a decided impetus, according to Mr. Tenney, revealing not only a general improvement in business conditions through the resumption of buying, but also an increased activity on the part of Marmon distributors and dealers. The Marmon sales director has just returned from an eastern trip during which he was supplied with ample evidence of business revival through increased automobile purchases and the optimistic outlook of the Marmon distributive organization.

MACK ANNOUNCES NEW SIX-CYLINDER MODEL AK TRUCK

(Continued from Page 1)

ward and one reverse, and is driven by a single plate dry type clutch.

Final drive is by either chain or inclosed gears. The inclosed drive is of the Mack dual reduction type. This type of drive is full-floating and each gear assembly is independently accessible without jacking up the axle or disturbing the wheels or brakes. A 45-degree tilt to the banjo type axle is designed to give strength and road clearance compatible with the generous size of gears. The chain drive used on the Mack Model AK six is of the type used on Mack AC Bulldog trucks for many years.

Steering is of the worm and nut type. Front axle is of the reversed Elliot type with center point steering.

Brakes are on all four wheels and are of the expanding type. They are in two independent sets, the foot brakes being vacuum booster actuated, and the hand lever operating a secondary set on the drive shaft.

Long springs are mounted in Mack rubber shock insulators. Standard wheel base lengths of 174, 186 and 198 inches are available.

HAROLD NUTT BECOMES DURANT CHIEF ENGINEER

Lansing, Mich., Sept. 25.—Harold Nutt, associated with the engineering department of Durant Motors for more than eight years, has been named chief engineer to succeed Roy E. Cole, factory executives announce.

Cole, who has been well known in automotive circles for nearly a quarter of a century, announced his resignation from Durant Motors this week. Before aligning himself with the Durant organization two years ago he had been chief engineer with Dodge Brothers.

Nutt was formerly stationed at the Elizabeth, N. J., Durant factory before coming here.

CHEVROLET TO GO ON AIR WITH WAR HERO PROGRAM

Detroit, Sept. 25.—Early in October the Chevrolet Motor Company will go on the air over more than one hundred radio stations throughout the country in the first of a series of weekly programs to continue late into the fall.

Each week there will be presented the personally narrated experience of prominent American war veterans who have received the highest honors within the power of the government to bestow for valor in action. Capt. E. V. Rickenbacker, ace of American aces, will act as host to the heroes and will introduce them to the air audiences. Each program, to be known as "Chevrolet Chronicles," will be a half hour duration. Because of the extent of the Chevrolet dealer organization between 110 and 120 radio stations will be used.

Scaling of Steel at Forging Temperatures

(Continued from Page 11)

be observed that although air and carbon dioxide produce very nearly the same quantity of scale after 20 and 40-minute exposures, the 80-minute exposures show a decided difference with the carbon dioxide producing the greater amount of scale. With 160-minute exposures this difference is definitely widened. It is probable that the scale formed with carbon dioxide permits easier diffusion or solution of the oxidizing gas than does the scale formed with air so that when the thickness of the scale becomes appreciable its effect becomes noticeable.

Mixing either steam or carbon dioxide with nitrogen reduces the amount of scale formed, as shown in Fig. 6. Since nitrogen produces no scale and has no effect, the dilution with nitrogen produces the same effect of reduced pressure of the active gas and affords an easy means of finding the effect of reduced pressure.

Although with nitrogen mixtures a uniform curve of scaling loss is obtained, it would be unsafe to predict the scaling effect of a mixture of two gases which individually caused scaling. Due to the possibility of variation in the physical and chemical properties of the scale produced such a prediction would be unwise. For instance, in the products of combustion of ordinary city gas burned with just the quantity of air to produce complete combustion, will be found nitrogen, carbon dioxide and steam. Such a mixture might contain about 17 per cent. steam, 13 per cent. carbon dioxide and 70 per cent. nitrogen. According to the results obtained, it would be expected that with 17 per cent. steam and 83 per cent. nitrogen, 5.20 per cent. of iron would be removed by scaling, and with 13 per cent. carbon dioxide and 87 per cent. nitrogen, 1.69 per cent. of iron would be removed. The reasoning thus far is correct, but it would be erroneous to assume that with the combination of these gases one should expect an amount of scaling equivalent to the sum of the two values or 6.80 per cent. loss. Results of tests have shown that the loss in weight is much lower than may be expected with 17 per cent. steam and 83 per cent. nitrogen, even without the addition of the 13 per cent. of carbon dioxide. A different type of scale is formed than with steam or carbon dioxide, and it is believed that this scale acts as a better protector than that formed with the steam.

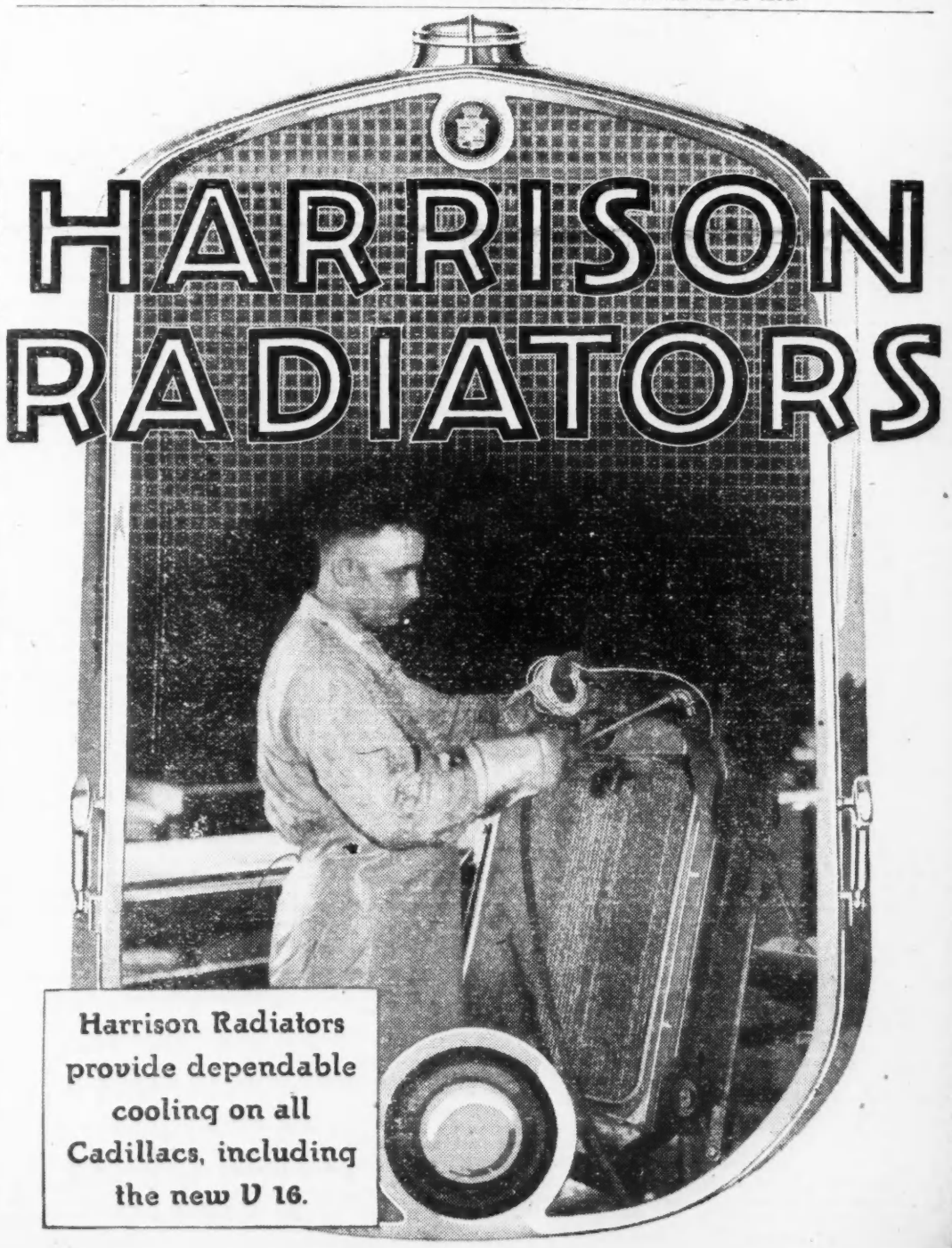
Summary

As a result of scaling tests made on plain carbon steel at forging temperatures air, steam, carbon dioxide and oxygen, the following generalizations seem justified:—

1. Increasing the rate of flow of the gas between 0 and 2 feet per minute causes a very marked increase in the rate of scaling at 2300 degrees Fahrenheit. With air or carbon dioxide, relatively little change in the rate of scaling is produced by increasing the rate of flow from 2 to 10 feet per minute. With these gases no change is produced with rates of flow higher than 10 feet per minute. In the case of steam, a noticeable increase in the rate of scaling occurs with increase in rate of flow from 2 to 15 feet per minute, and a very small increase in scaling rate up to 60 feet per minute, after which increasing the rate of flow has no effect on rate of scaling.

2. Increase in temperature causes increase in scaling rate. Between 2400 and 2500 degrees Fahrenheit, the scaling rate increases sharply. When heated to 2375 degrees Fahrenheit in nearly pure oxygen ordinary plain carbon steel oxidizes so rapidly that it is melted by the heat liberated in the chemical reaction with oxygen. When heated to about 2425 degrees Fahrenheit in air, the steel becomes hotter than the furnace atmosphere, but does not liberate enough heat to melt a low carbon steel.

3. Increase in time of exposure causes increase in the amount of scale produced, but decrease in the rate of oxidation.

4. Scale on steel acts as a partial protection against further scaling. The type of scale formed has a decided influence on the further rate of scaling.

5. Under the conditions obtaining in this research the average iron content of the scale formed with air approaches that of Fe_2O_3, and the average iron content of scale formed in carbon dioxide or steam approaches that of FeO.